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ABSTRACT

An integrated competency-based course of study in the sciences is provided in the handbook for North Carolina teachers of grades K-12. Recommended goals, objectives, and suggested measures for each subject and skill area related to the sciences are outlined. This guide contains: (1) an introduction (defining North Carolina's basic educational program); (2) philosophy and rationale (highlighting the characteristics of effective teachers and schools); (3) thinking skills (providing explanations and examples for each specified category of thinking and questioning skills); (4) programs for exceptional children (explaining the purposes and curricular goals for special needs learners); (5) notes for handbook users (including directives and suggestions in the use of this guide). The science competency-based curriculum is explained by grade level and subject area. Topic outlines are provided. Appendices contain course requirements and standards, testing and textbook information and state guidelines and services. (ML)

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TEACHER HANDBOOK

SCIENCE K-12

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**North Carolina
Competency-Based
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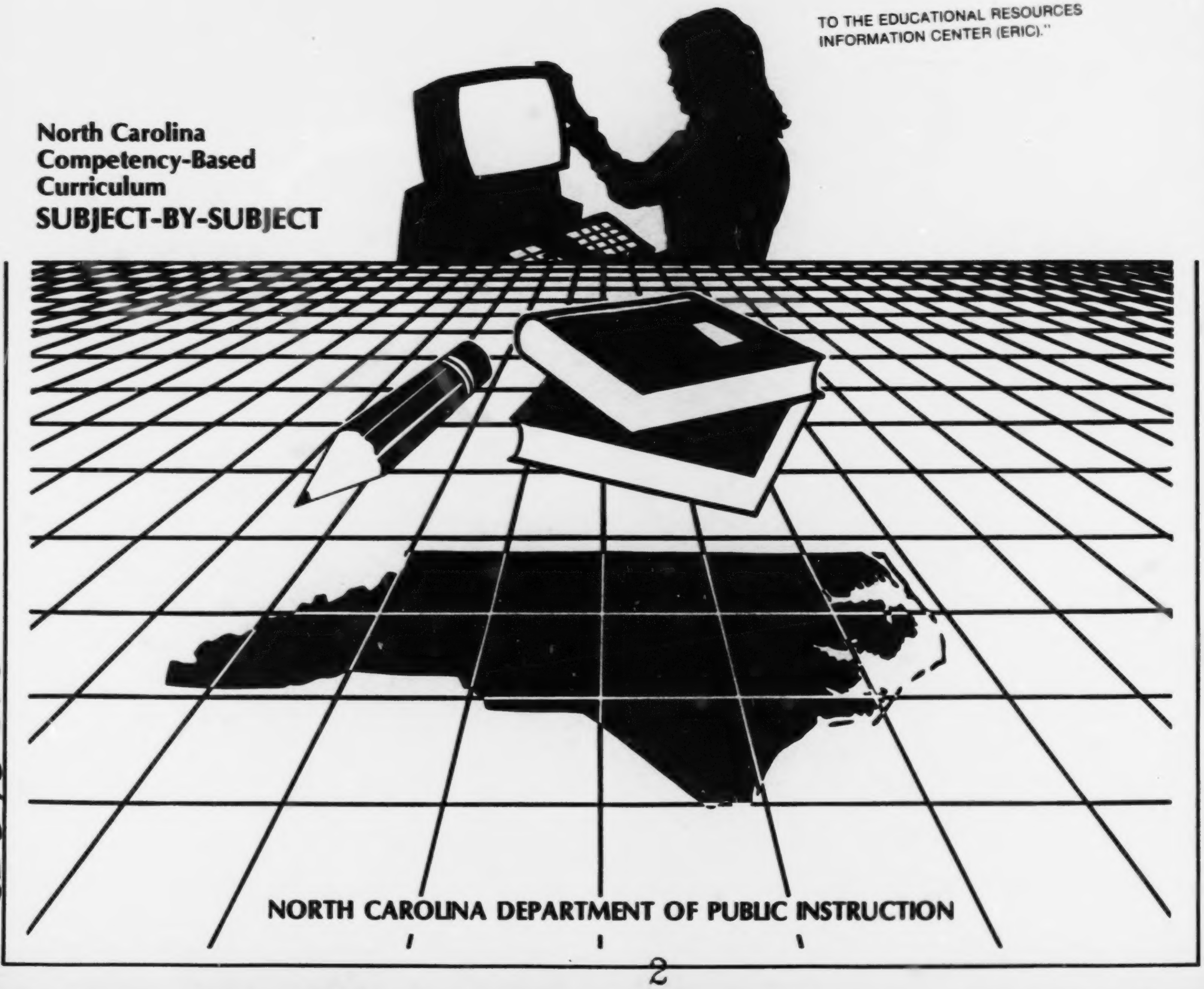

NORTH CAROLINA DEPARTMENT OF PUBLIC INSTRUCTION

SE046 565

TEACHER HANDBOOK

SCIENCE

GRADES K-12

North Carolina Competency-Based Curriculum

Division of Science
Instructional Services
North Carolina Department of Public Instruction

Raleigh, North Carolina
1985

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Foreword

As a result of the Elementary and Secondary School Reform Act of 1984 and the appropriation which accompanied this act, the North Carolina State Department of Public Instruction engaged in an extensive audit and revision of curriculum throughout the summer and fall of 1984. The products of this work, the North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum, provide a detailed, integrated basic course of study for all subjects at all grade levels.

The North Carolina General Assembly has also made a commitment to the development of a basic education program. This program includes the staffing and material support needed for the full implementation of the North Carolina Standard Course of Study and the competency-based curriculum in all public schools throughout the State. The financial support of the General Assembly and the work of educators throughout the State in developing the competency-based curriculum are important contributions to our continuing efforts to provide a quality education for every child residing in North Carolina.

A. Craig Phillips
State Superintendent of Public Instruction

Acknowledgements

The Instructional Services Area of the Department of Public Instruction acknowledges with gratitude the outstanding cooperation and assistance we have received from individuals and groups throughout the State of North Carolina. Without such cooperation, the development and printing of the North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum would not have been possible.

We wish to express a special thanks to:

- the North Carolina General Assembly for providing the funds to make this important work possible,
- more than 8000 local educators who participated in the writing of the documents and in reacting to early drafts,
- almost 300 persons from institutions of higher education who advised the staff and assisted in the development of the curriculum,
- Raleigh-based and regional staff in the Divisions of Arts Education, Communication Skills, Computer Services, Exceptional Children, Healthful Living, School Media Programs, Mathematics, Science, Social Studies, Student Services, and Vocational Education. These Public Instruction staff members carried the primary responsibility for planning, writing, and editing the curriculum.
- the Controller's Office in the Department of Education for excellent assistance in designing a computer program for storing and printing the Standard Course of Study and the competency-based curriculum,
- the Division of School-Community Relations for technical assistance in the publication of the documents,
- all areas of the Department of Public Instruction for their encouragement and invaluable assistance in numerous ways,
- Kay Barbour and Janice Royster who word-processed the entire 8000 pages, and
- especially Dr. Barbara Holland Chapman who coordinated the development of the Standard Course of Study and the competency-based curriculum. Her untiring efforts have contributed significantly to the quality of these documents.

The involvement of the entire education community in the writing of the curriculum truly makes it a North Carolina curriculum of which the State can be justifiably proud. We look forward in the coming years to working with all of you in revising and improving the competency-based curriculum in order that it will continue to meet the needs of the children of North Carolina.

Joseph B. Webb

Joseph B. Webb
Assistant State Superintendent
Instructional Services

BACKGROUND AND OVERVIEW

7

Introduction

Immediately following the passage of the Elementary and Secondary Reform Act in June of 1984, the area of Instructional Services within the North Carolina State Department of Public Instruction began a revision of the North Carolina Standard Course of Study and the development of the Teacher Handbook for the competency-based curriculum. These efforts represent a significant part of the development of a basic education program for North Carolina's Public Schools.

Three publications hold the results of our efforts to define a basic education program for the State: The Basic Education Program for North Carolina's Public Schools, North Carolina Standard Course of Study, and the Teacher Handbook for the competency-based curriculum. The Basic Education Program for North Carolina's Public Schools outlines the curriculum, programs not confined to subject areas, general standards, material support, and staffing which should be provided in all schools throughout the State. The North Carolina Standard Course of Study, adopted by the State Board of Education, provides an overview of the basic curriculum which should be made available to every child in the public schools of our State. It includes the subject or skills areas of arts education, communication skills, guidance, healthful living, library/media skills, mathematics, science, second language studies, social studies, and vocational education as well as the philosophy and rationale underlying the curriculum and considerations which should be made in developing thinking skills and providing for the needs of exceptional children. The Teacher Handbook for the competency-based curriculum provides recommended goals and objectives and suggested measures for each subject or skills area.

The first step taken in auditing and refining the curriculum in each subject or skills area was to review and synthesize the reports of curriculum review committees and the work contained in two earlier publications (Course of Study for Elementary and Secondary Schools K-12 and Competency Goals and Performance Indicators). The next step was to involve educators from local education agencies and institutions of higher education in working with the North Carolina Department of Public Instruction staff to expand and refine the curriculum. Thousands of persons throughout the State have been involved in the development of the North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum.

Three important points should be kept in mind when reviewing these documents. First, while the curriculum represents the standard course of study which should be available to all children in North Carolina Public schools, many public schools in the State presently offer an even more comprehensive curriculum. Second, the standard course of study includes the curriculum that should be made available to every child, not what every child is actually required to take. Required subjects or courses are outlined in the appendices.

Third, the North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum will never actually be completed. Several steps have been taken to insure that the curriculum may be constantly updated: the documents have been entered on an IBM 5520 computer word-processing program for ease of revision and updating; the competency-based curriculum has been produced in loose-leaf form so that revised or additional pages may easily be added; and included in each document is the name of a contact person within the State Department of Public Instruction to whom staff in local education agencies or others may send suggestions for additions or revisions (Appendix I). As with any viable curriculum, these documents must be constantly open to review, expansion, and revision in order that they continue to meet the needs of the children of the State of North Carolina.

Philosophy and Rationale

The philosophy and rationale underlying the North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum imply a context in which the curriculum will be implemented. What follows are definitions of the purposes for which the curriculum was developed and the principles incorporated into its development as well as descriptions of who will implement it and where it will be successfully implemented.

Purposes and Principles

The primary purposes of the North Carolina Standard Course of Study and the competency-based curriculum are (1) to help students become responsible, productive citizens and (2) to help students achieve a sense of personal fulfillment. It is clear that there are competencies which a student must develop in order to meet both of these purposes.

Students must develop the specific competencies needed to gain employment or continue their education. These competencies include critical thinking skills, skills with media and technology, and the basic content knowledge provided within a core curriculum (arts education, communication skills, healthful living, mathematics, science, second language studies, social studies, and vocational education).

Students must develop the skills and attitudes necessary to cope with contemporary society. Among these are a positive attitude toward oneself, a sense of independence and responsibility for oneself, an understanding of oneself and one's own culture, a positive attitude toward others including those who come from different cultures, a respect for the rights of others, a sensitivity to the needs and feelings of others, a sense of responsibility to others, a willingness to cooperate with others in working toward a common goal, and the ability to understand and cope with a constantly changing society.

In order to help students become responsible, productive citizens who have a sense of personal fulfillment, commonly accepted principles of learning have been incorporated into the North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum. One of these principles is the importance of integrating the curriculum--of emphasizing the understanding of concepts and processes over the mere acquisition of isolated facts. Stressing the mastery of integrated knowledge helps students to move from what is known to an understanding of the unknown, to see relationships and patterns and begin to make generalizations, to understand the interrelatedness of the subject areas and skills areas, and to succeed in learning. An integrated curriculum helps students learn how to learn.

Another principle considered in the development of the North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum is that learners are more likely to attempt those tasks at which they feel they can succeed and which are relevant to their lives. If students are to be successful in school and if they are to pursue lifelong learning, they must see learning as worthwhile. The competency-based curriculum is, therefore, a program of continuous learning based upon the individual student's needs, interests, and stages of development. The curriculum provides opportunities for the student to develop self-expression, to learn to communicate effectively, to maintain and develop both physical and emotional health, to choose among curriculum electives, and to become an active participant in the learning process. The importance of personalizing the curriculum to help each student reach her/his maximum potential is stressed.

Effective Teachers

It is the classroom teacher at each grade level or in each subject area who has the most direct influence on the implementation of the North Carolina Standard Course of Study and the competency-based curriculum. The ultimate task of integrating the curriculum must be performed by the classroom teacher through preparation for instruction and presentation of content. Student success in learning is assured when teachers use the information gained through monitoring and evaluation to determine appropriate instructional tasks and to provide appropriate feedback to students. What the teacher presents and how the teacher presents it determines whether students feel the task is relevant to their lives. The teacher's efficient management of instructional time and student behavior are also important to the successful implementation of the curriculum in each classroom.

Effective Schools

Several common characteristics will be present in the schools which most effectively implement the North Carolina Standard Course of Study and the competency-based curriculum. These characteristics include strong instructional and administrative leadership by the principal of the school, dedicated and qualified teachers, an emphasis on curriculum and instruction, a positive school climate, ongoing evaluation based on student achievement, and good home/school relations. Strong instructional and administrative leadership by the principal means that the principal functions as the instructional leader, supports instructional effectiveness by the way in which the school is managed, and clearly communicates the school's mission to staff, students, and parents. Dedicated and qualified teachers care about their students, understand and support school-wide goals and procedures, work as a team, exhibit positive morale and enthusiasm for their work, and demonstrate their good training through application of the skills involved in quality teaching. An emphasis on curriculum and instruction includes clearly stated school-wide goals and objectives, structured staff development based on the school's goals, curriculum continuity (alignment among school-wide goals, instructional approaches, materials used, and the assessment of students' needs, abilities, and interests), and a high percentage of student time-on-task. Elements of a positive school climate are a safe and orderly environment, a perceptible feeling of pride and school spirit in all that the school does, the communication of high academic and social expectations to students, and opportunities for student responsibility and involvement. Ongoing evaluation based on student achievement begins with early identification of students' needs, abilities, and interests, includes frequent monitoring of student progress in multiple ways (teacher observation, classroom activities, homework, teacher-made tests, mastery skills checklists, criterion-referenced tests), and results in appropriate instructional prescriptions to improve individual student performance and the school-wide instructional program. Good home/school relations are the outgrowth of effective, positive communication between the school and the home. This includes encouraging parents to help their children at home, making them feel they are appreciated by the school staff, and letting them know they are welcome in the school and have a part to play in school affairs. Good home/school relations increase parents' support of the school's instructional goals and disciplinary policies.

The characteristics described above will be found in the elementary, middle/junior high, and high schools which most effectively implement the North Carolina Standard Course of Study and the competency-based curriculum. However, in each of these schools consideration must be given to the unique development needs--intellectual, physical, social, and emotional--of the students served. For example, the need of young children for concrete, hands-on experiences; the need of middle school children for transitional experiences in curriculum choices, scheduling, and conseling; and the need of high school students for the variety of curriculum choices provided by the comprehensive high school.

The North Carolina Standard Course of Study and the competency-based curriculum represent a comprehensive, integrated course of study; however no document by itself has ever made the ultimate difference in the quality of education which children receive. Principals who function as instructional leaders and teachers who make use of their most effective teaching skills will appropriately implement the competency-based curriculum and thus insure that the children of North Carolina receive a quality education.

Thinking Skills

In order to become productive, responsible citizens and to achieve a sense of personal fulfillment, students must develop the ability to think. Thinking skills should be developed and reinforced throughout the curriculum and during every activity of the school day. It is also important that students be helped to apply these skills to "real life" situations outside the school.

The most frequently used system for classifying thinking skills is Bloom's (1956) Taxonomy. This system, with adaptations made by Sanders (1966) and Soar et al. (1969), was used in the integration of thinking skills throughout the Teacher Handbook for the competency-based curriculum. These skills fall into seven broad categories--memory, translation, interpretation, application, analysis, synthesis, and evaluation.

The most basic thinking skills are memory and translation. Memory involves the ability to remember specific pieces of information or facts such as names, dates, events, and rules. Translation requires the student to remember specifics and to understand or express them in her/his own terms. One example of a translation skill is the student's ability to restate a classroom rule in her/his own words. Another example is the ability to read the mathematical symbol "+" as "plus".

Remembering isolated bits of information or even restating that information in one's own words does not necessarily require reasoning on the part of the student. Higher-level thinking skills are defined as those processes which require thinking or reasoning above the levels of memory or translation--interpretation, application, analysis, synthesis, and evaluation.

Students begin to demonstrate their ability to reason through interpreting information, applying what is learned in one situation to a new situation, and analyzing information. Ways in which a student might demonstrate the ability to interpret information are to list the similarities and differences between two or more objects or to tell why a particular classroom rule was established. A student demonstrates a degree of ability in the category of application when s/he is able to explain how the principle of representative government at the state and federal levels may apply to the election of officers to the student council. A student who reads a newspaper editorial and is able to distinguish fact from opinion, point out unstated assumptions, and recognize bias is demonstrating skills of analysis.

When students apply skills of analysis, they are taking apart a whole. When students apply synthesis skills, they are creating a whole that is unique or new to them. Synthesis is usually equated with creativity. Composing a song, building a model house, or formulating a hypothesis during a science experiment are examples of synthesis activities.

Evaluation is distinct from opinion in that evaluation is the conscious making of judgments based on evidence or criteria. Opinion is usually formed from an emotional or affective base. Students serving as jurors during a simulated trial are using evaluation skills or making judgments based on evidence. Students critiquing one another's writing based on established elements of style are using evaluation skills or making judgments based on criteria.

To insure that students develop higher-level thinking skills they should be guided in the use of these skills in each subject area at each grade level and in their application to "real life" situations. When developing lesson plans, teachers should prepare tasks and questions at a variety of cognitive levels. However, strict adherence to previously prepared questions may inhibit rather than enhance a class discussion. Furthermore, it is often difficult to think of appropriately worded higher-level questions in the midst of a good classroom discussion. The following simple strategies will lead to the asking of higher-level questions and the giving of higher-level responses:

1. Before starting an activity, explain to the learner what you are going to do.
2. Before starting an activity, give the learner time to familiarize her/himself with the materials.
3. Ask questions which require multiple word answers.
   (e.g., "Why did he choose that path?")
4. Ask questions which have more than one correct answer.
   (e.g., "What things make people happy?")
5. Encourage the learner to enlarge upon her/his answer.
   (e.g., "Tell us more about that.")
6. Get the learner to make judgments on the basis of evidence rather than by guessing.
   (e.g., "You said . . . Read the line in the book that made you think that.")
7. Give the learner time to think about the problem; don't be too quick to help.
   (e.g., Wait at least five seconds before prompting or asking another question.)
8. Get the learner to ask questions.
   (e.g., "If the astronaut were in our classroom, what questions would you ask her?")
9. Praise the learner when s/he does well or takes small steps in the right direction.
10. Let the learner know when her/his answer or work is wrong, but do so in a positive or neutral manner. (Desirable Teaching Behavior Task Force, 1976)

The following are examples of two levels of activities (K-1 and above K-1) within the seven categories of thinking skills and two categories of questions or statements (affectivity and procedure) outside the seven categories of thinking skills:

Florida Taxonomy of Cognitive Behavior--K-1 Form (Soar et al., 1969)

1. Memory--items at this level are intended to represent no activity other than rote memory. The pupil is expected to give back an idea in the same form it was given, without changing the nature of the idea or the form in which it was expressed.

   a. repeats from memory
   b. repeats other
   c. repeats in sequence
   d. choral response
   e. spells
   f. gives/receives information
   g. seeks information

2. Translation--the intent of this category is to identify pupil activities involved in changing the form in which an idea is expressed, but not in changing or manipulating the idea itself.

   a. sounds letters
   b. names pictures, objects, colors, letters
   c. copies letter, number, work (learned)
   d. gives/follows directions
   e. describes situation, event
   f. reports experience (2+ thoughts)
   g. describes situation, event
   h. recognizes word (sight words)
   i. translates one language into another or vice versa (e.g., math symbols into words or Spanish into English)
   j. asks/gives permission
   k. puts into own words

3. Interpretation--the activities in this category are those of making comparisons, identifying similarities or differences, identifying relatedness, or carrying out a process in which the child has previously been instructed, when told that the process is appropriate.

   a. sounds out word
   b. classifies (1 attribute)
   c. counts
   d. adds/subtracts
   e. uses units, tens
   f. compares letters, numbers
   g. copies letters(s), number(s)--learning
   h. gives class name (vehicle, etc.)
   i. identifies similarities, differences
   j. asks/gives reason (opinion)
   k. names sensation
   l. performs learned task or process
   m. relates terms (e.g., 1/first, little/small, purple/violet/lavender)
   n. makes comparisons
   o. describes what may be seen to be happening in a picture

4. Application--one of the central aspects of application is that the student is able to select from past learning that which is appropriate for the current situation, and apply it. In interpretation a process was carried out when specified, but here the pupil must decide her/himself what process should be applied. Organization and the interrelationships between two or more ideas are central.

   a. classification (2+ attributes)
   b. directs learning game
   c. creates arithmetic problem
   d. writes/types sentence
   e. asks/tells who, what, or where
   f. seriates (alphabetizes)
   g. applies previous learning to new situation
   h. reads (thought unit)
   i. selects and carries out process

5. Analysis--the central elements in this category are those of inferring causation, motivation, or feelings from information given about the setting and the behavior of the people involved, or of identifying information which supports a conclusion, or establishing the accuracy of a process. The selection and use of relevant supporting data is the central process.

   a. verifies equation balance
   b. infers feeling or motive
   c. infers causality (tells why)
   d. cites evidence for conclusions

6. Synthesis--the central idea of the synthesis category is that the child organize ideas in a way that is new to her/him, or projects probable consequences of a given behavior, or formulates a plan or set of rules to deal with anticipated difficulties, or produces something which is new to her/him.

   a. elaborates on picture or story
   b. proposes plan or rule
   c. play-acts
   d. makes up story
   e. makes fantasied object (e.g., sand or clay)
   f. makes common object (e.g., sand or clay)
   g. draws/colors common object
   h. draws/colors fantasied object
   i. makes predictions based on available facts

7. Evaluation--the central concept of evaluation is that there must exist a set of standards or criteria against which behavior or some sort of product is compared.

   a. compares with criteria or rule
   b. compares with plan

Florida Taxonomy of Cognitive Behavior (Brown et al., 1968)

1. Knowledge (memory)

1.1 Knowledge of Specifics--requires the memorization of information or knowledge which can be isolated or remembered separately, the smallest meaningful bits.

a. reads
b. spells
c. identifies something by name
d. defines meaning of term
e. gives a specific fact
f. tells about an event

1.2 Knowledge of Ways & Means of Dealing with Specifics--requires knowledge about the manner in which specific information is handled--the ways of organizing, working, and evaluating ideas and phenomena which form the connecting links between specifics. It does not require the learner to deal actually with the specifics her/himself, but rather to know of their existence and possible use. Thus, s/he may be expected to state a previously encountered principle or generalization, but not to develop one. The items which belong to this category refer to processes rather than products of processes; they usually represent higher abstractions than the items of the preceding category.

a. recognizes symbol
b. cites rule
c. gives chronological sequence
d. gives steps of process, describes method
e. cites trend
f. names classification system or standard
g. names what fits given system or standard

1.3 Knowledge of Universals & Abstractions--deals with the highest of abstractions at the memory level. In order to evidence this behavior the individual must know major generalizations, their interrelations, and patterns into which information can be organized and structured. These items reflect the major concepts which comprise the framework of a discipline or major area of knowledge. The four items in this category are descriptions of behavior which would identify or verbalize a major concept.

a. states generalized concept or idea
b. states a principle, law, or theory
c. tells about organization or structure
d. recalls name of principle, law, or theory

2. Translation--is dependent upon possession of relevant knowledge. The task is to convert communication into known terms; it requires the understanding of the literal message in the communication. Communication is used here in its broadest sense; it could be a demonstration, a field trip, a musical work, a verbal message, or be demonstrated in pictorial or symbolic form.

a. restates in own words or briefer terms
b. gives concrete example of an abstract idea
c. verbalizes from a graphic representation
d. translates verbalization into graphic form
e. translates figurative statement to literal statement or vice versa
f. translates foreign language into English or vice versa

3. Interpretation--individual not only identifies and comprehends ideas, as in translation, but also understands their relationships. It goes beyond repetition and rephrasing the parts of a communication to determine the larger and more general ideas contained in it. Thus, comprehension may require reordering into a new configuration in the mind of a person, involving the determination of the relative importance of ideas and the interrelationships. However, the thinking is dependent upon what is given to the student--s/he is not expected to bring abstractions from other experiences into the situation.

a. gives reason (tells why)
b. shows similarities or differences
c. summarizes or concludes from observation of evidence
d. shows cause and effect relationship
e. gives analogy, simile, metaphor
f. performs a directed task or process

4. Application--individual must know an abstraction well enough to be able to demonstrate its use in a new situation. The task is to bring to bear upon given material or situation the appropriate information, generalizations or principles that are required to solve a problem. Application, as distinguished from comprehension, involves transfer of training. It is based on an individual's being able to apply previous learning to a new or novel situation without having to be shown how to use it. The problem itself is given.

a. applies previous learning to a new situation
b. applies principle to new situation
c. applies abstract knowledge in a practical situation
d. identifies, selects, and carries out process

5. Analysis--describes cognitive behavior in which there is an emphasis on the breakdown of material into its parts in order to detect the relationships of the parts and the way they are organized. The first four items at this level describe skills used in the identification or classification of the elements of the communication.

a. distinguishes fact from opinion
b. distinguishes fact from hypothesis
c. distinguishes conclusions from statements which support it
d. points out unstated assumption
e. shows interaction or relation of elements
f. points out particulars to justify conclusion
g. checks hypothesis with given information

   h. distinguishes relevant from irrelevant information
   i. detects error in thinking
   j. infers purpose, point of view, thoughts, feelings
   k. recognizes bias or propaganda

6. Synthesis (creativity)--represents cognitive activities in which the individual puts together elements and parts in order to form a whole in such a way as to constitute a pattern or structure that was not stated before. This entails recombining parts of earlier experiences in a new organization that is unique to the synthesizer. In analysis, the person takes apart a given whole; in synthesis s/he creates a whole.

   a. reorganizes ideas, materials, processes
   b. produces unique communication or divergent idea
   c. produces a plan, proposed set of operations
   d. designs an apparatus
   e. designs a structure
   f. devises scheme for classifying information
   g. formulates hypothesis, intelligent guess
   h. makes deductions from abstract symbols, propositions
   i. draws inductive generalization from specifics

7. Evaluation--describes activities of conscious judgment making; involves use of criteria or standards to determine the worth or value of methods, materials, or ideas. Evaluations must be distinguished from opinions which are usually made from an emotional or affective base.

   a. evaluates something from evidence
   b. evaluates something from criteria

Noncognitive Categories of Questions/Statements or Tasks (Davis & Tinsley, 1967)

Affectivity--questions/statements or tasks which elicit feeling, emotion, or opinion without a standard of appraisal, e.g., "How does the story make you feel?" or "Wasn't that a good story!"

Procedure--questions/statements or tasks related to organization, behavior, or management, e.g., "Are you listening to me?" or "Please get ready for class to begin."

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Programs for Exceptional Children

Exceptional children are (1) learners who because of permanent or temporary mental, physical, or emotional handicaps need special education and are unable to have all their educational needs met in a regular class without special education or related services, or (2) learners who demonstrate or have the potential to demonstrate outstanding intellectual aptitude and specific academic ability and, in order to develop these abilities, may require differentiated educational services beyond those ordinarily provided by the regular school program. Classifications of exceptional children include those who are autistic, academically gifted, hearing impaired (deaf or hard of hearing), mentally handicapped (educable, trainable, or severely/profoundly), multi-handicapped, orthopedically impaired, other health impaired, pregnant, behaviorally/emotionally handicapped, specific learning disabled, speech/language impaired, and visually impaired (blind or partially-sighted).

The primary purpose of exceptional children programs is to insure that handicapped and gifted learners develop mentally, physically, and emotionally to the maximum extent possible through the provision of an appropriate, individualized education in the proper setting.

Curricula for most exceptional learners follow the curricula designed for learners in general education. However, modification of instructional programs, creative instructional approaches, individualized programming, and appropriate selection and use of curricula are necessary to meet the special needs of exceptional learners. In curricula, emphasis must be given to instruction in arts education, communication skills, healthful living, mathematics, library/media skills, science, social studies, and vocational education. Attention must be focused upon cognitive, affective, psychomotor, and vocational development within the curricular areas. The Individualized Education Program for the handicapped and the Group Education Program for the academically gifted, both of which are based upon a comprehensive assessment, are to state in writing the special curricular offerings to be provided to each exceptional learner.

The Individual Education Program for the handicapped requires objective criteria, evaluation procedures, and schedules for determining, on at least an annual basis, whether or not short-term instructional objectives have been achieved. The Group Education Program for the academically gifted requires annual goals and evaluation methods. All special education instruction provided to handicapped and academically gifted learners is to be individualized and designed to meet unique learning needs.

Learning outcomes--knowledge, skills, concepts, understandings, and attitudes--for the handicapped and the academically gifted will differ from learner to learner. For many exceptional learners, the same learning outcomes developed for learners in general education will be appropriate. Some exceptional learners will meet the learning outcomes at a different time and in a different manner than learners in general education. Some handicapped learners might not meet the learning outcomes in general education and will need a totally different curriculum.

The majority of handicapped and academically gifted learners spend a portion of their instructional day within general education, integrated into classes with non-handicapped and nonacademically gifted learners. General education teachers, as well as exceptional education teachers, must be familiar with curricula and capable of selecting appropriate curricular goals and objectives based upon the unique educational needs of each learner as determined by comprehensive assessment, and as stated in the Individualized Education Program for exceptional learners, emphasis needs to be placed on instructional techniques rather than differentiated or modified curricula.

While the general education curricula are appropriate for most exceptional learners, there are times when the teacher must vary the curricular content: some children are not ready for certain types of curricular content at the usual age; some disabilities prevent or make difficult participation in certain learning experiences; different levels of ability may limit or encourage participation in certain school subjects; and some learners spend less time in school. Curricular choice is determined by need.

Curricular goals must be oriented toward skills and application instead of general knowledge. The goals must include skills related to maintaining health, communicating ideas, achieving personal and social growth, handling money concerns, working with measurements, getting along in an expanding community, coping with the physical environment, maintaining a home, using leisure time, and career development.

The competency-based curriculum is to be maximized for exceptional learners. Teachers must be familiar with the curriculum, making judicial use of it in the instructional program for handicapped and academically gifted learners.

Notes to Those Using the TEACHER HANDBOOK

The North Carolina Standard Course of Study, adopted by the State Board of Education, provides an overview of the basic curriculum which should be made available to every child in the public schools of our State. It includes the subject or skills areas of arts education, communication skills, guidance, healthful living, library/media skills, mathematics, science, second language studies, social studies, and vocational education as well as the philosophy and rationale underlying the curriculum and considerations which should be made in developing thinking skills and providing for the needs of exceptional children. The Teacher Handbook for the competency-based curriculum provides recommended goals and objectives and suggested measures for each subject or skills area.

Definitions

Competency Goals:	broad statements of general direction or purpose.
Objectives:	specific statements of what the student will know or be able to do.
Measures:	a variety of suggestions for ways in which the student may demonstrate s/he is able to meet the objective.

How to Read the Goals, Objectives, and Measures

Competency Goals have been written as complete sentences stating why the learner should be able to meet the stated objectives, e.g., "The learner will know causes and events of the settlement of the West."

For purposes of clarity and brevity Objectives have been written as phrases or clauses beginning with a verb, e.g., "Know the importance of railroads in the settlement of the West." These phrases or clauses would logically be preceded by "The learner will (know the importance of railroads in the settlement of the West)."

For purposes of clarity and brevity Measures have also been written as phrases or clauses beginning with a verb, e.g., "Describe the advantages of the railroad over horse-drawn wagon, river transportation, and other commonly used methods of transportation." These phrases or clauses would logically be preceded by "One way (or some ways) a student may demonstrate s/he is able to meet successfully the objective is to (describe the advantages of the railroad over horse-drawn wagon, river transportation, and other commonly used methods of transportation)."

Appendix E is an example of a page from the Teacher Handbook for the competency-based curriculum.

Student Placement

From kindergarten through eighth grade each skill or subject area has been divided into grade levels. This was done in order to make it easier for teachers to gain a general idea of what should be covered at each grade level. In order that instruction fit the individual needs of each student, it is most important that the classroom teacher use the activities in the Measures column to determine the appropriate placement for each child. For example, if a second-grade student is not able to complete successfully the Measures in the reading skills section at the second-grade level, Measures at the first-grade or kindergarten level should be administered. When the base level at which the child can perform successfully has been determined, instruction should begin with and proceed from that level of Competency Goals and Objectives.

The Measures column includes a variety of suggested means for assessing student performance including informal measurements (e.g., manipulatives, oral reports, role playing, projects, and some paper and pencil activities) and formal measurements (e.g., items for teacher-made tests, criterion referenced tests, and/or standardized tests). Some of the items in this column may be administered in whole-group or small-group situations; others should be given only to individual students. These items may be used for the purpose of pretesting to determine appropriate student placement, for monitoring ongoing student progress, and/or for post-testing to determine student learning.

It is apparent that in order for students to be placed appropriately for instruction (particularly in first through eighth grade), each teacher must have at least one, and preferably two or more, grade levels of the competency-based curriculum on each side of the grade s/he is teaching. It must be remembered that the higher the grade level the greater the span of students' needs and, therefore, the greater the need for a teacher to have a wider grade span of the curriculum available. An adequate grade span of the curriculum is also important for teachers of exceptional children at all grade levels.

Responsibility for Implementation

The North Carolina Standard Course of Study specifies which skills and subjects are to be taught at each grade level from kindergarten through grade twelve. The skills to be taught or developed at all grade levels are communication skills, library/media skills, thinking skills, and affective skills. The subjects to be taught from kindergarten through grade six are arts education, healthful living, mathematics, science, second language studies, and social studies. The same subjects, with the addition of vocational education, are to be taught in grades seven through twelve.

The Teacher Handbook for the competency-based curriculum provides recommendations for what should be taught in each skills or subject area from kindergarten through eighth grade and in each course from ninth through twelfth grade. Each teacher's primary responsibility is to teach the subject(s) or courses which s/he is specifically assigned, as well as to help students develop thinking and affective skills. However, each teacher also has a responsibility for appropriately integrating other skills (communication, library/media) and subjects (arts, healthful living, mathematics, science, second language studies, social studies, and vocational education) into the skills or subject areas which are her/his specific assignment.

Teachers in departmentalized schools at the middle/junior high or secondary levels have a responsibility for integrating curriculum in several ways. These include: (1) the integration of curriculum within their subject area in order to help students to make a smooth transition from one level to the next, e.g., from English I to English II, from Algebra I to Algebra II, from French II to French III; (2) the appropriate integration and development of those skills which are every teacher's responsibility (thinking and affective skills); and (3) whenever appropriate, the integration of other skills and subjects into their specifically assigned subject or skills area.

The Teacher Handbook for the competency-based curriculum serves as a resource guide for the integration of all skills and subjects in departmentalized situations. Teachers may look over the curriculum within the specific skills or subject area for which they are responsible in order to determine the overall scope and sequence. They may look at the outlines for thinking and affective skills in order to determine which of those skills have been integrated into their particular segments of the curriculum or to determine how they may integrate additional thinking and affective skills. Looking over other skills and subject areas will help teachers determine what should be appropriately integrated into their own areas. For example, while it is a primary responsibility of the high school English teacher to teach writing and speaking skills, the high school social studies teacher must be familiar with those skills and has a responsibility for reinforcing those skills in the written and oral work done in the social studies classes. Prior to beginning written and oral reports the social studies teacher should review the writing and speaking skills portions of the communications skills curriculum, using these as guidelines for instruction and the development of student assignments. Similar examples could be given with mathematics and science teachers or English and vocational education teachers.

Teachers in self-contained classrooms at the elementary, middle/junior high, or high school levels have the primary responsibility for integrating the curriculum in a variety of ways. These include: (1) integrating the curriculum within each skills or subject area in order to help students make a smooth transition from one grade level to the next; (2) integrating thinking skills and affective skills throughout all areas of the curriculum; (3) the integration of skills and subjects whenever possible though units of study;

(4) integrating skills and subjects introduced by teachers or specialists outside the homeroom into what is being taught within the homeroom; and (5) coordinating the efforts of teachers outside the homeroom (teachers of arts education, physical education, exceptional children, and library/media specialists, or guidance counselors) in order to supplement the homeroom curriculum. The Teacher Handbook for the competency-based curriculum serves as a guide for the integration of skills and subjects in self-contained situations as it does in departmentalized situations.

The principal shares in the responsibility for the successful implementation of the competency-based curriculum. The implementation and integration of the curriculum should be the focal point for decisions made by the principal in the role of instructional and administrative leader. Decisions made with respect to scheduling, disposition of student discipline, uninterrupted time for classroom instruction, and the distribution of materials and supplies may each serve to facilitate or frustrate the successful implementation and integration of the curriculum.

Staff within the area of Instructional Services at the North Carolina Department of Public Instruction also share responsibility for the successful implementation of the competency-based curriculum. Staff from the Regional Education Centers and Raleigh are, of course, available to assist Local Education Agencies in the implementation of the curriculum.

Use of Textbooks

The North Carolina Standard Course of Study is the curriculum approved for the public schools of North Carolina. Textbooks supplement this curriculum. With reference to their appropriateness for use with the North Carolina Standard Course of Study, textbooks are reviewed and recommended by the Textbook Commission. The State Board of Education then adopts a list of textbooks from which school districts make individual selections. Appendix G is a description of this process. If textbooks are at variance with the curriculum, the North Carolina Standard Course of Study takes precedence.

Computer Access

The North Carolina Standard Course of Study and the Teacher Handbook for the competency-based curriculum (with the exception of mathematics grades 7-12) have been entered on the IBM 5520 computer at the State Department of Public Instruction. Each skills or subject area at each grade level has been entered as a separate document. This allows Local Education Agencies, Institutions of Higher Education, and others with access to the mainframe in Raleigh to call up and print out any portion of the curriculum, e.g., any skills or subject area across all grade levels, all skills and subjects for one particular grade level, one subject at one grade level, or the entire competency-based curriculum. Those with access to the mainframe will, therefore, have immediate access to any revisions or additions to the curriculum.

Activities and Resources

The development or cataloging of activities and resources to assist in the implementation of the competency-based curriculum is an ongoing activity of Instructional Services staff working with teachers and others in each of the Local Education Agencies. Concentrating this effort in the local school districts provides teachers the opportunity to become familiar with the curriculum. As activities and resources are developed for each skills or subject area, they will be made available for State-wide dissemination through the IBM mainframe.

Working Space

Working space has been left at the end of goals throughout the Teacher Handbook for the competency-based curriculum. This space has been provided so that teachers may write in additional objectives and measures and/or make notes regarding instruction, activities, and resources.

How to Make Suggestions for Additions or Revisions

As with any viable curriculum, the Teacher Handbook for the competency-based curriculum must be open to constant review, expansion, and revision in order that it continue to meet the needs of the children of this State. Anyone having suggestions for additions to or revisions of this curriculum may complete and submit the form in Appendix I, or may contact:

Joseph B. Webb
Assistant State Superintendent
for Instructional Services
Education Building
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Science

COMPETENCY-BASED CURRICULUM

NORTH CAROLINA DEPARTMENT OF PUBLIC INSTRUCTION

SCIENCE

PURPOSE AND OVERVIEW

The primary goal of American education is to develop thinking and reasoning ability. The nature of science readily lends itself to this central purpose. Thus, the science curriculum, by emphasizing rational thought processes through active participation in scientific methods, will ensure that each child will become scientifically literate. Achieving scientific literacy is essential if an individual is to successfully cope with a rapidly changing scientific and technological world. It is most important that science instruction be available to each child at all grade levels.

The science program meets the basic needs of all students when appropriate emphasis is placed on four major goal clusters*:

1. Personal Needs that prepare individuals to utilize science for improving their lives and for coping with an increasingly technological world,

2. Societal Issues that produce informed citizens prepared to deal responsibly with science-related social problems,

3. Academic Preparation that allows students who are likely to pursue science academically as well as professionally to acquire knowledge appropriate to their needs, and

4. Career Education/Awareness that gives all students an awareness of the nature and scope of a wide variety of science and technology-related careers open to students of varying aptitudes and interests.

The goals of science education, realized through science instruction, are to:

1. Understand certain scientific concepts and facts.

2. Develop the skill to manipulate and/or operate science equipment.

*Harms, Norris C., and Yager, Robert E., eds. What Research Says to the Science Teacher, Volume 3. National Science Teachers Association, 1981.

3. Become proficient in using science process skills: observing, predicting, interpreting data, classifying, controlling variables, inferring, formulating hypotheses, experimenting, measuring, formulating models, communicating, using numbers, defining operations, and using space/time relationships.

4. Acquire attitudes necessary for living successfully in and contributing positively to a technological society.

5. Foster intellectual development.

6. Develop an appreciation for the uses, benefits, and limitations of science to society.

7. Develop problem-solving and decision-making skills.

8. Foster creativity as a human endeavor.

The science curriculum is based on a continuum of fundamental concepts and skills from kindergarten through grade 12. A balanced curriculum is offered through the study of the three major areas of science--biological, physical, and earth/space.

Students gain a greater understanding of the fundamental concepts and become more proficient in the skills of science as they progress from the lower to the upper grades. Concepts and skills serve as the basic framework for the science program in grades K-12.

The child's first experiences with science, from the earliest grades, should involve aspects of experimental inquiry. Use is made of all the senses in developing such skills as observing, measuring, classifying, using numbers, and communicating. Three important aspects of science--process (doing), content (knowledge), and attitudes (feelings and values)--are kept in the forefront during all phases of planning and instructing. The three cannot be totally separated. To help assure success, learning experiences must be presented at the appropriate developmental level for each student. In this way, the end product is rewarding and provides each student with a sense of accomplishment. Laboratory and field work are very important to the teaching of science at all levels. These activities provide ways for making science more understandable and meaningful.

Current science and technology provide many opportunities for a student to select and prepare for a science or science-related occupation. A well-balanced science curriculum provides students with an awareness of educational and career opportunities available through: (1) study of the historical development of science, (2) study of science technological advances, (3) use of nonschool resource persons, (4) field trips, and (5) on-site studies. Such activities enhance self-development attitudes toward work, decision-making, and appreciation of various lifestyles.

Careful selection of course content and instructional aids for the various grade levels and individual courses is done to ensure that each child will have an understanding of basic science concepts and have the capability to use the processes of science. Because of individual differences, students will develop competence in science unique to themselves. The curriculum is designed for all students. Variation is made by instructional leaders and teachers in the local school units in the final selection of methods of instruction and strategies to be used with students of varying abilities and interests.

Elementary science (K-6) is considered an essential component of the elementary curriculum and should be taught daily throughout the year. Science instruction at this level is of an integrated nature with studies during each year emphasizing various areas of earth, physical, and life sciences. The curriculum is experiential, with major emphasis on concrete learning experiences.

In grades 7 and 8, the study of science is an integrated form of life, earth, and physical science; instructional time and depth of content are increased. Content should be presented from a student-centered perspective, placing emphasis on the nature of science and inquiry. Instruction should be largely laboratory-oriented, stressing scientific methods through application of process skills. Problem-solving and reasoning are essential experiences in the learning process. Scientific inquiry deals with both academic and real world problems. Personal needs, societal issues, and academic and career preparation are interwoven into the course content. Energy, environmental concerns, and recent advances in science technology permeate the curriculum.

Beginning in grade 9, the student starts studying a single subject or area of science such as physical science or biology on a year-long basis. There is a continuation of presenting content with emphasis on the nature of science and scientific inquiry. Students in grades 9-12 are encouraged to enroll in elective science courses in addition to the basic graduation requirements. To increase student enrollment and provide a more comprehensive science curriculum, two types of courses are offered.

One type, applied/technical, is designed for the secondary student who is interested in a program which places emphasis on the practical and applied aspects of science. These courses should stress doing science through the use of manipulatives and laboratory work, presenting science as a practical and relevant subject. Math requirements are limited to basic functions. The courses emphasize socially relevant topics and recent developments in science. The basic philosophy reflects an attitude that science is a process of finding out about our universe, is understandable, and that anyone can achieve and benefit from learning science. A wide variety of evaluation techniques is employed for measuring achievement of course objectives. In determining grades, major emphasis is placed on laboratory and project work that involves problem-solving. Pencil and paper tests play a minor role in evaluation.

The second type of course is designed for the more academically inclined student. Students electing these courses for graduation requirements are also allowed to enroll in applied/technical courses as electives and vice versa. The academic courses are challenging and reflect a philosophy of science as inquiry. Emphasis is placed on using current technology as students investigate relevant problems through research and project work. The courses demand competence in communication and mathematical skills. Course content centers on current developments and includes socially relevant issues. Evaluation techniques are varied and test questions are phrased to require responses involving high-level thinking. Memorization of low-level factual information is de-emphasized.

COURSE OF STUDY

K-6
Elementary Science

7-8
Integrated Science

9-12

Academic Courses*	Applied/Technical Courses*
Physical Science	Physical Science
Biology	Biology
Earth Science	Earth Science
Chemistry	Chemistry
Physics	Physics

*Students may take courses from either or both groups.

Some high schools offer advanced courses (2nd year), advanced placement courses (college first level), and enrichment courses. Course outlines and final examinations for the advanced placement courses are provided by the College Entrance Examination Board. Topics and areas of science included in the advanced courses (2nd year) and in the enrichment courses are determined by the particular desires and interests of the students for whom the courses are provided. Such courses are designed at the local school system level. Variation within these courses reflects the particular desires and interests of students throughout the state. These elective courses may include Advanced Biology, Advanced Chemistry, Anatomy and Physiology, Applied Science, Astronomy, Geology, Field Botany, Environmental Studies, Advanced Physics, Aviation Science, Independent Study, and others appropriate to the local science program.

The science competency-based curriculum:

- is designed for statewide use.
- offers flexibility for local curriculum development.
- is not correlated with any textbook and does not restrict the use of any relevant textbook or program.
- encourages the offering of a series of courses suitable to the varying abilities of all students.
- assumes that there are individual differences among students and that the degree and rate of achievement will vary among them.
- assumes that teachers are different and will approach the teaching of science differently.
- stresses concept learning and process skills attainment through activity-oriented science programs.

LEARNING OUTCOMES

The learning objectives listed below are the basis for the total framework of the science curriculum. The objectives are composed of concepts, attitudes, and process skills. These permeate the curriculum. Careful attention should always be given to them when program development and/or instructional planning are being done.

1. Concepts

    a. Biological

        (1) There are many kinds of living things.
        (2) The basic unit of living things is the cell.
        (3) Living things exhibit basic similarities and differences.
        (4) Living things grow, develop, reproduce, and die.

- (5) Living things are a product of heredity and environment.
- (6) Living things exist in a state of interdependence.

b. Physical

- (1) All matter is composed of tiny particles called atoms.
- (2) Matter takes up space and has mass.
- (3) Matter exists as a solid, liquid, or gas.
- (4) Energy and matter interact to produce changes.
- (5) Energy takes many forms and can be converted from one form to another.
- (6) Universal forces (gravitational, magnetic, electrical, and nuclear) affect all objects.
- (7) Matter and energy are conserved.

c. Earth/Space

- (1) The sun is the earth's chief source of energy.
- (2) The earth's atmosphere, lithosphere, and hydrosphere are always changing and interacting.
- (3) The position and movement of the Earth in space causes many changes such as the seasons and day and night.
- (4) The earth/moon interaction exhibits various effects.
- (5) Rocks and fossils provide evidence of the earth's history.
- (6) Universal forces affect the solar system, stars, and galaxies.

2. Attitudes (Positive) Toward:

a. The contributions of science and technology in shaping the world.

b. The role of science in helping people meet their responsibilities to society.

c. The need for conservation, preservation, and wise use of natural resources.

d. The learning and experiencing of science.

e. The use of scientific inquiry as a way of thinking and evaluating all human activity.

f. The uncertainties that underlie many of the laws of science.

g. The historical background of science.

3. Process Skills

a. Observing
b. Classifying
c. Using space/time relations
d. Using numbers
e. Communicating
f. Measuring
g. Inferring
h. Predicting
i. Interpreting data
j. Controlling variables
k. Defining operationally
l. Formulating hypotheses
m. Experimenting
n. Formulating models

Process Skills Defined:

a. *Observing* involves using one or more of the senses in perceiving properties or similarities and differences in objects and events. Observations can be made directly with the senses or indirectly through the use of simple or complex instruments. Observations are influenced by the previous experience of the observer.

b. *Classifying* involves the sorting or ordering of objects according to their properties or similarities and differences. Classification is based on observational relationships which exist between objects or events.

c. *Using space/time relations* means describing the spatial relationships of objects and their change with time. Examples of this process skill are motion, direction and spatial arrangement, symmetry, and shape.

d. *Using numbers* is a means of quantifying measurements or comparisons. Numbers are needed to manipulate measurements, order, and classify objects.

e. *Communicating* involves the transmission of observable data. Examples of communication media are spoken or written words, graphs, drawings, diagrams, maps, and mathematical equations. Such skills as asking questions, discussing, explaining, reporting, and outlining can aid the development of communication skills.

f. *Measuring* is the ordering of things by magnitude such as area, length, volume, and mass. Measuring helps quantify observations. The process can involve the use of instruments and the skills needed to effectively use them.

g. *Inferring* involves the use of logic to make conclusions from observations. Inferring suggests explanations, reasons, or causes for events. Inferences are based on judgments and are not always valid.

h. Predicting involves suggesting what will occur in the future. Predictions are based on observations, measurements, and inferences about relationships between or among observed variables. Prediction is speculation of what will happen based on past experiences. Accuracy of a prediction is closely affected by the accuracy of the observation.

i. Interpreting data is a complex skill involving many of the other process skills. It involves making predictions, inferences, and hypotheses from a set of data. Interpretations may need revision when additional data are obtained.

j. Controlling variables is the managing of the conditions or factors in an experiment. Unless the variables of an experiment can be carefully regulated, the results of the experiment are not reliable.

k. Defining operationally is stating definitions in working terms. Such definitions limit the meaning of a term to "what is done" and "what is observed." Example of a working definition: A dry cell, when properly connected with two wires and a light bulb, will cause the bulb to glow.

l. Formulating hypotheses involves forming a generalization question based on observations. The hypothesis is a problem to be solved through using other process skills, especially experimenting. Questions, inferences, and predictions can lead to the formation of a hypothesis. The hypothesis must be tested if its credibility is to be established.

m. Experimenting involves testing a hypothesis under controlled conditions in which variables are limited. Experimenting is basic to the total scientific process and uses all of the other process skills.

n. Formulating models is a useful way of describing and explaining interrelationships of ideas. A model can be a mental, physical, or verbal representation of an idea. Models represent what we know about an idea or concept and are constantly changing as new data are obtained.

GRADES K-3

Major Emphases

Emphasis is placed on the curiosity and exploratory nature of the child. Instruction centers on daily phenomena of nature from which one develops a central storehouse of experiences--light and dark, cold and heat, motion and rest, forms of matter and life. Such experiences, through manipulative "hands-on" activities, provide opportunities for the use and development of science skills and lead gradually to the understanding of basic science and environmental concepts. Making use of out-of-class resources such as field trips, visits to zoos and museums, outside speakers and presenters also is important. With these children, development of science process skills is more important than a correct answer or finished product. A balanced program is provided by placing emphasis on the concepts related to each of the broad areas of science--biological, physical, earth/space. In selecting and planning experiences, careful attention must be given to the physical and intellectual development of each child. Science at this level should always be an enjoyable and "doing" experience.

Kindergarten offers a unique and rich environment for studying science. Emphasis centers on readiness skills that help refine and develop the child's sensory mechanisms. Readiness skills and science knowledge may well be attained through experiences encompassing an integration of various content areas. Subject matter studied and "hands-on" experiences of children relate to their past experiences and present environment. Science concepts and process skills are acquired as children learn to observe, describe, and discriminate among objects and organisms. The student is given the opportunity to observe and experience the properties of matter such as color, size, shape, texture, smell, and weight, and to work with plants, animals, and numbers.

As children progress beyond kindergarten, they are ready for more formal science experiences. The program provides more concrete, manipulative "hands-on" experiences which give broad coverage to science in general. These experiences assist the child in developing an understanding of matter, energy, motion, time, space, diversity, interaction, and change.

Grade K Outline

1. Life Science

    1.1 Plants and animals
    1.2 The human body
    1.3 The senses

2. Physical Science

    2.1 Basic properties of matter (color, size, shape, texture, odor, taste, sound)
    2.2 Position of objects
    2.3 Quantity of objects
    2.4 Change in the environment

3. Earth Science

    3.1 Air
    3.2 Soil
    3.3 Water
    3.4 Weather

SCIENCE

Grade Level: K Skills/Subject Area: Elementary Science

COMPETENCY GOAL 1: The learner will have an understanding of basic life science concepts.

Objectives		Measures	
1.1	Recognize there are many kinds of living things.	1.1.1	Name different kinds of animals.
		1.1.2	Name different kinds of plants.
		1.1.3	Describe basic similarities of animals.
		1.1.4	Describe basic similarities of plants.
		1.1.5	Describe basic differences of animals.
		1.1.6	Describe basic differences of plants.
		1.1.7	Describe basic differences between plants and animals.
1.2	Know basic parts of the human body.	1.2.1	Name major parts of the body when shown a picture of the human body (head, neck, arms, hands, fingers, legs, feet, toes, elbows, knees, and wrists).
		1.2.2	Count the number of different body parts as listed in 1.2.1.
1.3	Know the basic functions of the body's senses.	1.3.1	Name the sense organs and identify their function when shown a picture of the human body.
		1.3.2	Use the basic senses in making observations of objects.

Grade Level: K Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have an understanding of basic physical science concepts.

Objectives		Measures	
2.1	Know that matter has basic properties such as color, size, shape, texture, sound, and odor.	2.1.1	State the properties of various common objects.
		2.1.2	Distinguish between objects using a single property.
		2.1.3	Classify objects using a single property.
2.2	Describe the position of objects.	2.2.1	Describe the position of objects using words such as up, over, under, beside, in front of, behind, left, and right.
		2.2.2	Describe the position of objects in reference to the child's body using words such as above, below, in front of, and behind me.
2.3	Describe the quantity of objects.	2.3.1	Describe quantities of objects such as more than, less than, the same as.
		2.3.2	Count the number of objects in a given set.
2.4	Describe changes in the environment.	2.4.1	Describe seasonal changes when shown appropriate pictures.
		2.4.2	Describe differences between day and night.
		2.4.3	Describe how people change as they grow.

Grade Level: K Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have an understanding of basic earth science concepts.

Objectives		Measures	
3.1	Know that air is all around us.	3.1.1	Show that air is all around us.
		3.1.2	Show that air moves.
		3.1.3	Show that air occupies space.
		3.1.4	Show that air has weight.
3.2	Have knowledge about soil.	3.2.1	Show how sand is formed (grinding or rubbing rocks together).
		3.2.2	Show how organic matter (compost pile) is formed.
		3.2.3	Show that soil is a mixture of organic and inorganic matter.
		3.2.4	Show that soil is important for good plant growth.
3.3	Know the importance of water to living things.	3.3.1	Show that plants need water.
		3.3.2	Show that animals need water.
		3.3.3	Show that food contains water.
		3.3.4	Show that people use water.

Grade Level: K Page 2

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have an understanding of basic earth science concepts.

Objectives	Measures
3.4 Know that our weather is constantly changing.	3.4.1 Discuss different weather conditions such as rainy, sunny, cloudy, hot, cold.
	3.4.2 Describe weather according to seasons.
	3.4.3 Describe how living things, such as a deciduous tree, change from season to season.
	3.4.4 Describe clothing needs for different weather conditions.
	3.4.5 Discuss violent weather conditions such as tornadoes, hurricanes, and thunderstorms.
	3.4.6 Demonstrate the appropriate student behavior when violent storms are approaching.

Grade 1 Outline

1. Life Science

    1.1 How animals are alike and different

        a. size and shape
        b. color
        c. habits
        d. movement
        e. homes
        f. sounds

    1.2 Needs of animals

        a. water
        b. food
        c. oxygen
        d. shelter
        e. space

    1.3 Care of animals

        a. farm animals
        b. pets
        c. wild animals

    1.4 How plants are alike and different

        a. color
        b. size
        c. habitat

    1.5 Needs of plants

        a. water
        b. soil
        c. light
        d. air
        e. temperature

2. Physical Science

    2.1 Matter

        a. properties of matter
        b. common materials
        c. measuring

- 2.2 Sources of energy
- 2.3 Chemical changes in matter
- 2.4 Heat sources
- 2.5 Wave energy

    - a. light (mirrors, shadows)
    - b. sound (producing sound, voice, musical instruments)

- 2.6 Mechanical energy (examples of machines, force--push or pull)
- 2.7 Electrical energy--magnets

3. Earth Science

    - 3.1 Rocks--properties
    - 3.2 Earth--our home and its history
    - 3.3 Air and water properties

SCIENCE

Grade Level: 1 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 1: The learner will have a basic understanding of life science concepts.

Objectives	Measures
1.1 Know that animals are alike and different.	1.1.1 Describe how animals are alike and different in size and shape when shown pictures of common animals.
	1.1.2 Describe the colors of different animals.
	1.1.3 Discuss the habits of common animals or pets.
	1.1.4 Name and group animals that fly, swim, walk, crawl, run, or hop.
	1.1.5 Match common animals with their homes when shown pictures of each.
	1.1.6 Describe the sounds that are made by common animals.
1.2 Know that animals have basic needs.	1.2.1 State that all animals need water for survival.
	1.2.2 Describe the food needs of three different types of animals.
	1.2.3 State that oxygen is needed for all animals to survive.
	1.2.4 Match the types of homes to the animals when shown pictures of each.
	1.2.5 List several animals that require much space to meet their food, water, and shelter needs.
	1.2.6 List several animals that require little space to meet their food, water, and shelter needs.

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 1: The learner will have a basic understanding of life science concepts.

Objectives		Measures	
1.3	Know basic care for farm, pet, and wild animals.	1.3.1	Describe the food needs of several farm animals.
		1.3.2	Describe the shelter needs of several farm animals.
		1.3.3	Describe the food needs of classroom or home pets.
		1.3.4	Describe the shelter needs of classroom or home pets.
		1.3.5	Describe how some wild animals provide for their own care.
		1.3.6	Describe the dangers of handling wild animals.
1.4	Know how plants are alike and different.	1.4.1	Describe several common plants according to their colors.
		1.4.2	Describe several common plants according to their size.
		1.4.3	Match plants with their habitat when shown pictures of each.
1.5	Know the basic requirements of plants.	1.5.1	Grow plants when provided seeds and appropriate materials.
		1.5.2	Demonstrate, through projects or simple experiments, that plants need water, light, and air to grow properly.
		1.5.3	Demonstrate that plants need to have an optimum temperature for growth.

SCIENCE

Grade Level: 1 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have a basic understanding of physical science concepts.

Objectives	Measures	
2.1 Know basic concepts of matter.	2.1.1	Name four properties such as size, shape, weight, color, and texture, when given an object.
	2.1.2	Group objects according to the properties of weight, size, shape, and texture, when given a collection of different objects (six to ten).
	2.1.3	Describe properties of common objects through use of the senses of touch and smell.
	2.1.4	Name materials of which common objects are made.
	2.1.5	Make simple metric length measurements of common objects.
2.2 Have a general knowledge of energy concepts.	2.2.1	Name common sources of energy such as wood, coal, oil, the sun, and batteries.
	2.2.2	State that energy is required in order to accomplish work.
2.3 Know that energy can be obtained from chemical reactions.	2.3.1	Demonstrate how energy can be obtained from batteries.
	2.3.2	State that when an object burns, chemical energy is released.
	2.3.3	Identify heat and light energy as the major forms of energy released when an object burns.

Grade Level: 1

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have a basic understanding of physical science concepts.

Objectives	Measures
2.4 Know basic concepts of heat energy.	2.4.1 Name three sources of heat energy.
	2.4.2 Record temperature readings when given a thermometer.
2.5 Know the general nature of wave energy.	2.5.1 Show that light energy is reflected by mirrors.
	2.5.2 Describe how shadows change as the source of light changes its position.
	2.5.3 Demonstrate that shadows are caused by blocking light energy.
	2.5.4 Demonstrate how sound can be produced by causing objects to vibrate.
	2.5.5 State that the sound of our voice is caused by making the vocal cords vibrate.
	2.5.6 Demonstrate how simple musical instruments work by causing parts to vibrate.
	2.5.7 Demonstrate that musical instruments operate by blowing, striking, or bowing the instrument.
2.6 Know simple principles of mechanical energy.	2.6.1 Name simple machines that help us do work.
	2.6.2 Demonstrate several simple machines when given a collection of machines.
	2.6.3 Demonstrate how a force of pushing or pulling helps us move objects.
	2.6.4 Demonstrate simple machines that push or pull.

Grade Level: 1

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have a basic understanding of physical science concepts.

Objectives		Measures	
2.7	Know basic concepts of electrical energy/ magnets.	2.7.1	Demonstrate that magnets can attract or repel each other.
		2.7.2	Demonstrate how magnets will attract some objects and not attract other objects.
		2.7.3	Name several uses for electricity.
		2.7.4	Name several safety rules relating to electricity.
		2.7.5	Name ways to conserve electrical energy.

SCIENCE

Grade Level: 1 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have a general understanding of earth science concepts.

Objectives	Measures
3.1 Describe the properties of common rocks.	3.1.1 Name several properties of common rocks when given samples.
	3.1.2 Name a common property of two different rock types.
3.2 Know that the earth provides the requirements for life.	3.2.1 Describe the different types of homes for different organisms (plants or animals).
	3.2.2 Demonstrate the ability to make appropriate homes for common classroom animals.
	3.2.3 State the requirements for all living things in respect to establishing homes.
	3.2.4 Name several animals that are known by their fossil remains.
3.3 Know the general properties of air and water.	3.3.1 Demonstrate that air takes up space when given appropriate materials such as a tumbler and a bowl of water.
	3.3.2 Demonstrate that air is all around us.
	3.3.3 Demonstrate that air can exert a force on objects.
	3.3.4 Name ways to conserve water.
	3.3.5 State several properties of water.
	3.3.6 Demonstrate that water can exist as a liquid, solid, or gas.

Grade 2 Outline

1. Life Science

    1.1 Animals around us

        a. physical description
        b. habitat
        c. food habits
        d. growth and development

    1.2 Animals in their environments

        a. food
        b. homes
        c. coats
        d. protective coloration
        e. hibernation
        f. migration

    1.3 Plants around us

        a. physical description
        b. growth

    1.4 How people use plants and animals

2. Physical Science

    2.1 Matter

        a. kinds of matter
        b. floating and sinking
        c. measuring matter

    2.2 Forms of energy
    2.3 Chemical energy
    2.4 Measuring heat energy
    2.5 Wave energy

        a. light (eye, colors)
        b. sound (transmission of sound waves, ear)

    2.6 Mechanical energy

        a. how machines help us do work
        b. forces--push or pull

2.7 Electrical energy

   - a. magnets (natural magnets, making magnets)
   - b. static electricity
   - c. current electricity (methods of producting electricity, safety)

3. Earth Science

   3.1 Weather
   3.2 Water
   3.3 Ancient ancestors--dinosaurs
   3.4 Solar system

   - a. sun (nature of the sun, distance to the sun, source of energy)
   - b. moon
   - c. planets (nature of planets, names of planets)

   3.5 Universe--stars

SCIENCE

Grade Level: 2 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 1: The learner will have an understanding of basic life science concepts.

Objectives	Measures
1.1 Know the basic needs and characteristics of animals.	1.1.1 Describe the physical characteristics of common animals.
	1.1.2 Group pictures of animals according to their characteristics.
	1.1.3 Place common animals in the proper habitat when given picture examples of each.
	1.1.4 Describe the food habits of several common animals.
	1.1.5 Describe the changes in growth and development from observations of classroom animals.
1.2 Know how living organisms adapt to their environment.	1.2.1 Identify the food needs of three different types of animals.
	1.2.2 Identify the homes of different animals when shown pictures of each.
	1.2.3 Describe the characteristics of the coats (hair, skin, fur, scales) of several diverse, but common, animals.
	1.2.4 Discuss how protective coloration helps animals survive.
	1.2.5 Match animals to their habitat according to their protective coloration.
	1.2.6 Name examples of several animals that hibernate.
	1.2.7 State why some animals hibernate.
	1.2.8 Name several examples of animals that migrate.

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 1: The learner will have an understanding of basic life science concepts.

Objectives	Measures
1.3 Have knowledge of plants and their growth.	1.3.1 Describe the basic parts of plants.
	1.3.2 Demonstrate how to germinate and grow a plant from a seed.
	1.3.3 Describe the life cycle of a plant when given pictures of plant growth stages.
1.4 Know how plants and animals are useful.	1.4.1 Describe common uses of plants other than food.
	1.4.2 Describe common uses of animals other than food.

SCIENCE

Grade Level: 2 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have an understanding of basic physical science concepts.

Objectives		Measures
2.1 Know the basic properties of matter.	2.1.1	Group objects according to the material of which they are made.
	2.1.2	Arrange objects in serial order according to a given property such as length, weight, and size when given a collection of objects.
	2.1.3	Predict which of a set of objects will float or sink, and test the prediction.
	2.1.4	Measure the length of common objects to the nearest centimeter.
	2.1.5	Record body mass using a bathroom-type scale.
	2.1.6	Measure volumes of liquids.
2.2 Know that energy has different forms.	2.2.1	Name several forms of energy such as electrical, heat, and light.
	2.2.2	Name common examples of heat, mechanical, and electrical energy.
2.3 Have knowledge of chemical energy.	2.3.1	Name common examples of sources of chemical energy such as food, gasoline, coal.
	2.3.2	Name examples of machines that use chemical energy.
2.4 Know how heat energy is measured.	2.4.1	Identify the thermometer as the instrument for measuring temperature when shown pictures of different instruments.
	2.4.2	Accurately record daily temperatures on a chart.

Grade Level: 2

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have an understanding of basic physical science concepts.

Objectives	Measures
2.5 Know the general nature of wave energy.	2.5.1 Identify the eye as the organ that responds to light energy.
	2.5.2 Demonstrate that white light is composed of seven basic colors when given a prism.
	2.5.3 Name spectral colors.
	2.5.4 State that bright light causes the pupil of the eye to get smaller.
	2.5.5 Demonstrate how sound can travel through solid objects when given appropriate materials.
	2.5.6 Demonstrate that sound waves can travel through air.
	2.5.7 Demonstrate that sound waves can travel through liquids.
	2.5.8 Demonstrate a model of sound waves when given a slinky.
2.6 Have knowledge of how machines help us do work.	2.6.1 List several machines that help people do work.
	2.6.2 Demonstrate how a simple lever can help do work.
	2.6.3 Give examples of machines that push or pull.
	2.6.4 Perform an experiment to show that heavier objects require a stronger force to move them.

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have an understanding of basic physical science concepts.

Objectives	Measures
2.7 Have knowledge of the nature of electrical energy.	2.7.1 Identify a natural magnet when shown examples of natural and manufactured magnets.
	2.7.2 Demonstrate ability to magnetize a steel pin when given a bar magnet.
	2.7.3 Demonstrate that magnets have poles that attract and repel each other.
	2.7.4 Demonstrate that like poles repel and unlike poles attract.
	2.7.5 Demonstrate the interaction of a comb and bits of paper when the comb has been rubbed through the hair.
	2.7.6 Identify batteries as a source of electricity.
	2.7.7 Identify a generator as a machine for producing electricity.
	2.7.8 Identify solar cells as devices for producing electricity from light.
	2.7.9 Name common safety rules when using electricity.
	2.7.10 Name ways to conserve electricity.

SCIENCE

Grade Level: 2 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have an understanding of basic earth science concepts.

Objectives		Measures	
3.1	Have knowledge about the nature of weather.	3.1.1	Describe different weather types and record weather patterns.
		3.1.2	Describe changing weather patterns by making drawings.
3.2	Know how bodies of water form.	3.2.1	Demonstrate how water evaporates.
		3.2.2	Make drawings showing clouds raining and water flowing to the river and sea.
		3.2.3	Show that most of the earth's water is located in the oceans when given a map or globe.
		3.2.4	Name two oceans and show their location on a map.
		3.2.5	Describe a watershed as all of the land drained by a particular body of water.
3.3	Have knowledge of prehistoric life.	3.3.1	Describe two types of dinosaurs that once lived on the earth.
		3.3.2	Describe the habitat of two dinosaurs.
		3.3.3	Describe the types of food dinosaurs consumed.
		3.3.4	Describe fossils as the remains of prehistoric life.

Grade Level: 2

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have an understanding of basic earth science concepts.

Objectives	Measures
3.4 Have knowledge of the solar system.	3.4.1 Describe the sun as the star nearest the earth.
	3.4.2 Describe the sun as our major source of energy.
	3.4.3 Predict that a rock placed in sunlight will get hotter than one placed in the shade.
	3.4.4 State that the sun is very far from the earth.
	3.4.5 State that the moon is our closest neighbor in space.
	3.4.6 Draw a picture showing the earth-moon-sun relationships.
	3.4.7 Demonstrate the motion of the moon around the earth when given an appropriate model.
	3.4.8 Discuss characteristics of several of the planets.
	3.4.9 Name some of the planets.
	3.4.10 Describe the revolution of the planets around the sun in words or through a drawing.
	3.4.11 Name gravity as the force affecting the solar system.
3.5 Have knowledge of the stars and universe.	3.5.1 Describe stars as very distant suns.
	3.5.2 Draw pictures of several common constellations.

Grade 3 Outline

1. Life Science
    - 1.1 Helpful and harmful plants and animals
    - 1.2 Defense mechanisms
    - 1.3 Plant and animal reproduction
    - 1.4 Interdependence of animals and plants
        - a. balance of nature
        - b. people's effect on the balance of nature
        - c. conservation
    - 1.5 Differences between living and nonliving things
2. Physical Science
    - 2.1 Matter
    - 2.2 Forms of energy
    - 2.3 Chemical and physical change
    - 2.4 Heat energy
        - a. temperature measurement
        - b. home temperature control
    - 2.5 Wave energy
        - a. light (camera, optical instruments)
        - b. sound (wave nature of sound, speed of sound, music)
    - 2.6 Mechanical energy
    - 2.7 Electrical energy
        - a. magnets (electromagnets, compass, uses of magnets)
        - b. static electricity
        - c. electric current (nature of electric current, safety)
3. Earth Science
    - 3.1 History of the earth
    - 3.2 Rock types
    - 3.3 Soil
        - a. formation
        - b. types

3.4 Water cycle

- a. ocean
- b. air
- c. ground

3.5 Forces changing the earth

- a. weathering
- b. erosion
- c. earthquakes
- d. volcanoes

3.6 Time

- a. day and night
- b. seasons
- c. year

3.7 Moon

3.8 Space

- a. rockets
- b. satellites
- c. space travel
- d. benefits to people

SCIENCE

Grade Level: 3 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 1: The learner will have an understanding of basic life science concepts.

Objectives	Measures
1.1 Know that plants and animals can be helpful and harmful.	1.1.1 Group pictures of familiar plants and animals into helpful and harmful categories.
	1.1.2 Name common plants and plant parts that are useful as a source of food.
	1.1.3 Name common animals that are useful as a source of food.
	1.1.4 Name plants and animals that are useful for things other than food.
1.2 Know that living organisms have defense mechanisms.	1.2.1 Name the defense mechanisms of three common plants.
	1.2.2 Name the defense mechanisms of several common animals.
1.3 Know that plants and animals are capable of reproducing their kind.	1.3.1 Draw the stages of the life cycle of a flowering plant.
	1.3.2 Demonstrate the ability to germinate common seeds and grow them to maturity.
	1.3.3 State that a viable seed contains a living embryo.
	1.3.4 List examples of animals that reproduce by eggs.
	1.3.5 List animals that are reproduced by live birth.

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 1: The learner will have an understanding of basic life science concepts.

Objectives	Measures
1.4 Know how plants and animals are interdependent.	1.4.1 Discuss plants that are dependent on animals for pollination.
	1.4.2 List plants that are dependent on animals for seed dispersal.
	1.4.3 Discuss ways animals are dependent on plants.
	1.4.4 Discuss the need for all living things to have a continuous source of energy.
	1.4.5 Identify the correct food chain when given pictures of plants and animals.
	1.4.6 Discuss the process used by plants to acquire food.
	1.4.7 Identify consumers and producers when given a list of organisms.
	1.4.8 List basic requirements of living organisms.
	1.4.9 Describe an example of an animal/animal and animal/plant pair which shows mutual dependence.
	1.4.10 Identify similarities and differences in two communities when given examples.
	1.4.11 Construct a balanced terrarium and describe its significance to the natural world.
	1.4.12 Discuss beneficial and harmful effects people have had on the balance of nature.
	1.4.13 List several reasons for conserving our natural resources.

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 1: The learner will have an understanding of basic life science concepts.

Objectives	Measures
1.5 Know the basic differences between living and nonliving things.	1.5.1 Describe the basic needs of living organisms.
	1.5.2 Describe basic differences and similarities between living and nonliving things.

SCIENCE

Grade Level: 3 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have an understanding of basic physical science concepts.

Objectives	Measures
2.1 Have a general knowledge of matter.	2.1.1 Demonstrate that air has weight and volume when given appropriate materials.
	2.1.2 Demonstrate the states of matter when given an ice cube and appropriate materials.
	2.1.3 Weigh and measure objects in given units.
	2.1.4 Predict that a liquid will take the shape of a container when poured into the container.
	2.1.5 Demonstrate that water vapor will condense on the outside of a container filled with water and ice cubes.
2.2 Know that there are many forms of energy.	2.2.1 List several forms of energy such as electrical, light, and heat.
	2.2.2 State practical uses of energy such as heating, transportation, and machinery.
2.3 Have knowledge of chemical and physical changes.	2.3.1 Discuss how food provides chemical energy for all organisms.
	2.3.2 List several examples of physical changes such as melting of ice or mixing sugar and water.
	2.3.3 List several examples of chemical changes such as burning and rusting.

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have an understanding of basic physical science concepts.

Objectives	Measures
2.4 Have knowledge of heat energy as measured by temperature.	2.4.1 Describe and record the temperature changes that occur in the classroom during the day.
	2.4.2 Record the changes in temperature of a warm liquid over a period of time.
	2.4.3 Determine the temperatures of a light and a dark colored object when placed in the sun.
	2.4.4 Discuss the function of a thermostat in controlling temperature in the home.

Grade Level: 3

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have an understanding of basic physical science concepts.

Objectives	Measures
2.5 Have knowledge of the nature of wave energy.	2.5.1 Demonstrate that light travels in straight lines when given appropriate materials.
	2.5.2 Construct and discuss the operation of a pinhole camera.
	2.5.3 Give examples of common optical instruments.
	2.5.4 Draw simple lines representing light rays reflected from an object through a hand lens.
	2.5.5 Demonstrate the production of sound when given objects such as a rubber band or ruler.
	2.5.6 State that sound is produced when objects are caused to vibrate.
	2.5.7 Demonstrate that sound travels through objects when given a string telephone system.
	2.5.8 Discuss the speed of sound from observations made on the school grounds such as a hammer hitting a board at a distance from the observer.
	2.5.9 Discuss why lightning can be seen before it is heard.
	2.5.10 Demonstrate different sound pitches when given a rubber band.
	2.5.11 State that objects vibrate faster when they make higher pitches.
	2.5.12 State that music is a combination of pleasant sounds caused by combining many pitches and volumes.

Grade Level: 3

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have an understanding of basic physical science concepts.

Objectives	Measures
2.6 Have knowledge of how machines help us do work.	2.6.1 Demonstrate how to lift a heavy object using a lever.
	2.6.2 Demonstrate how a ramp can be used to raise a heavy load.
	2.6.3 Demonstrate how a pulley can help do work.
	2.6.4 List common examples of machines that help us do work.
2.7 Have knowledge of electrical energy.	2.7.1 Demonstrate how to make an electromagnet when given wire, battery, and an iron nail.
	2.7.2 Determine the relationship between the number of turns of wire and the strength of an electromagnet.
	2.7.3 Discuss practical uses of electromagnets.
	2.7.4 Demonstrate how to make a simple magnetic compass when given appropriate materials.
	2.7.5 List five examples of practical uses of magnets.
	2.7.6 Demonstrate how to produce static electricity when given a comb and bits of paper.
	2.7.7 Demonstrate how to make a static electricity detector when given a small bottle, paper clip, cork stopper, and a strip of aluminum foil.
	2.7.8 Demonstrate how to make a circuit when given a battery, bulb, and wire.
	2.7.9 Draw a simple diagram of the circuit as described in 2.7.8
	2.7.10 State the common dangers of electricity.
	2.7.11 List ways to conserve electrical energy.

SCIENCE

Grade Level: 3 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have an understanding of basic earth science concepts.

Objectives		Measures	
3.1	Have knowledge of the earth's history.	3.1.1	List some animals that lived in the geologic past.
		3.1.2	Describe how fossils are made.
3.2	Have knowledge of the basic rock types.	3.2.1	Describe how the three types of rocks are formed.
		3.2.2	Name a common example of each rock type.
		3.2.3	List some properties of each rock type.
3.3	Have general knowledge of soil types and their formation.	3.3.1	Separate and identify humus and sand as the basic components of soil.
		3.3.2	State that soil is formed when organic matter mixes with sand, clay, or silt.
		3.3.3	Distinguish between sandy and humus soils.
		3.3.4	Describe the effect of various types of soil on plant growth.
3.4	Have knowledge of the water cycle.	3.4.1	Describe how water accumulates in the oceans from the land and air.
		3.4.2	Demonstrate how water evaporates from the earth's surface and enters the atmosphere.
		3.4.3	Demonstrate how water can move through the ground.
		3.4.4	Draw and explain the water cycle.

Grade Level: 3

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have an understanding of basic earth science concepts.

Objectives		Measures	
3.5	Have knowledge of how forces are constantly changing the surface of the earth.	3.5.1	Describe common examples of weathering.
		3.5.2	Describe how streams can wear down rocks.
		3.5.3	Give examples of soil erosion.
		3.5.4	Describe two ways soil erosion can be reduced.
		3.5.5	Indicate on a world map where earthquakes generally occur.
		3.5.6	Describe how volcanoes help build new land masses.
3.6	Have knowledge of basic earth cycles relative to time.	3.6.1	Describe the time cycles of day and night.
		3.6.2	Demonstrate day and night when given a globe and a light source.
		3.6.3	Draw pictures illustrating the seasons.
		3.6.4	List the seasons in correct order.
		3.6.5	Show the passing of one year when given a sun-earth model.
3.7	Have a general knowledge of earth-moon motion.	3.7.1	Describe the motions of the moon around the earth when given an appropriate model.
		3.7.2	Describe how earth-moon motion affects the tide.

Grade Level: 3

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have an understanding of basic earth science concepts.

Objectives		Measures	
3.8	Have knowledge of space exploration and how it benefits people.	3.8.1	Demonstrate how rockets work when given a balloon.
		3.8.2	Discuss how satellites can be put in orbit with rockets.
		3.8.3	Discuss space travel around the earth and to the moon.
		3.8.4	Give two examples of how space travel has benefited people.

GRADES 4-6

Major Emphases

The intermediate grades science program is characterized by a continuation of the utilization of skills and the development of major science concepts that began at the primary level. Balanced coverage is given to the broad areas of science--living things, matter and energy, earth and space. The curriculum reflects the nature of the learner and the developmental stages of students. Science instruction allows the student to experience abstract science through concrete learning activities. Instruction should be largely laboratory-centered with stress on scientific methods through application of scientific process skills. Students have manipulative experiences that involve the construction and use of simple lab equipment with special emphasis on safety. The development of problem solving and reasoning skills is an essential part of the learning process. Inquiry methods are used to deal with real problems that are relevant to the student. Emphasis is placed upon the use of the integrative processes of science: controlling variables, formulating hypotheses, interpreting data, and designing experiments.

Personal needs, community and societal issues, and career awareness should be woven into the course content. The methods for doing this will vary among schools and teachers. Energy, environmental concerns, and recent advances in science and technology also permeate the curriculum.

Grade 4 Outline

1. Introduction

    1.1 What is science
    1.2 How science helps us
    1.3 Branches of science
    1.4 Current events

2. Living Things--Animals

    2.1 How animals are alike and different--characteristics
    2.2 One-celled animals
    2.3 Care of animals and their young
    2.4 Adaptation to environment
    2.5 Helpful and harmful animals
    2.6 Genetic changes in animals
    2.7 Interdependence of animals

3. Matter and Energy

    3.1 Metric measurement system
    3.2 Properties of matter
    3.3 States of matter
    3.4 Solutions and mixtures
    3.5 Crystals
    3.6 Atomic structure
    3.7 Elements and compounds
    3.8 Molecules and atoms
    3.9 Matter and energy
    3.10 Mechanical energy

4. Earth--Atmosphere

    4.1 The earth's atmosphere
    4.2 Weather and climate

5. Space

    5.1 Solar system
    5.2 Meteors and comets
    5.3 The universe

SCIENCE

Grade Level: 4 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 1: The learner will understand the nature and relationship of science to human endeavor.

Objectives		Measures	
1.1	Know that science is a way of finding out through observation and experimentation.	1.1.1	Discuss the science process skills (e.g., observing, classifying, measuring, communicating, predicting, interpreting simple data, controlling variables) and how they relate to scientific methods.
		1.1.2	Suggest ways of finding a solution(s) of a given science problem by using scientific methods.
		1.1.3	Interpret the results of a simple experiment such as the effects of light on bean seedlings when variables are controlled
1.2	Know that scientific discoveries help us live better.	1.2.1	List several ways scientists' discoveries have improved living conditions for people.
		1.2.2	Discuss current problems which scientists may help solve.
		1.2.3	Write a story or draw a picture illustrating common scientific inventions that have been developed within the past 100 years.
1.3	Know that science is divided into various branches.	1.3.1	Identify several major branches of science (e.g., biology, geology, astronomy, meteorology, chemistry, physics).
		1.3.2	Identify how some of the various branches of science interrelate.
		1.3.3	Construct a "branched tree" showing relationships among the different areas of science.

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 1: The learner will understand the nature and relationship of science to human endeavor.

Objectives		Measures
1.4 Be aware of current events in science.	1.4.1	Give a report on new discoveries which occurred during the past year.
	1.4.2	Name and tell about a scientist who has received a Nobel Prize within the last five years.

SCIENCE

Grade Level: 4 **Skills/Subject Area:** Elementary Science

COMPETENCY GOAL 2: The learner will have a general knowledge of animals.

Objectives	Measures
2.1 Know basic characteristics of animals.	2.1.1 Know the basic characteristics of animals.
	2.1.2 Identify different animals by groups such as fish, amphibians, insects.
	2.1.3 List basic needs of all animals such as food, protection, and air.
	2.1.4 Observe a live animal in the classroom and give a report of the observations.
2.2 Know that the simplest animals are composed of one cell.	2.2.1 List some one-celled animals such as the amoeba and paramecium.
	2.2.2 Observe some one-celled animals; have students draw diagrams of them and discuss how these animals function.
2.3 Know the relationship between animals and their young.	2.3.1 Describe how several types of adult animals protect their young.
	2.3.2 List the ways birds and mammals feed their young.
	2.3.3 Discuss how the young of some animals such as insects, reptiles, and amphibians are independent from birth or hatching.
2.4 Know that animals are adapted to their environment.	2.4.1 Tell how the color and shape of animals help them adapt to their environment.
	2.4.2 Compare the various beaks and claws of birds; discuss how specific birds adapt to the environment as a result of these differences.
	2.4.3 Discuss the behaviors of various animals and how these activities help animals to survive, e.g., migration, instinct.

Grade Level: 4

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have a general knowledge of animals.

Objectives		Measures	
2.5	Know that there are helpful and harmful animals.	2.5.1	Discuss some differences between venomous and nonvenomous snakes.
		2.5.2	Name beneficial and harmful insects and explain what they do within the environment
2.6	Know how traits of an animal are transmitted from one generation to the next.	2.6.1	Name ways offspring are like their parents.
		2.6.2	Explain how farmers select animals with the most desirable characteristics to improve future generations of farm animals.
		2.6.3	List several dominant and recessive inherited traits.
2.7	Know that animals are interdependent.	2.7.1	Trace a food chain beginning with green plants.
		2.7.2	Discuss the relationships of predator/prey, host/parasite, and mutual benefit.
		2.7.3	List foods eaten by humans which come from animals.
		2.7.4	Describe a clothing product which comes from animals.
		2.7.5	Discuss how humans must care for the environment to ensure that animals remain healthy and species survive.

SCIENCE

Grade Level: 4 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have a basic understanding of matter and energy.

Objectives		Measures	
3.1	Know how to use the metric system.	3.1.1	Make simple metric measurements in units of length, mass, volume, and temperature.
		3.1.2	State several advantages of using the metric system.
3.2	Know different properties of matter.	3.2.1	Describe properties such as color, size, shape, weight, and texture of given objects.
		3.2.2	Classify a given assortment of objects according to various properties.
3.3	Know three states of matter: liquids, solids, and gases.	3.3.1	Explain and demonstrate, using water, that matter can change from liquid, solid, and gaseous states according to varying temperatures.
		3.3.2	Classify a given sample of matter according to its present state.
3.4	Know about solutions and mixtures.	3.4.1	Make and describe a solution from given ingredients.
		3.4.2	Make and describe a mixture from given ingredients.
		3.4.3	Explain or demonstrate differences in mixtures and solutions.
3.5	Know that some solids are composed of crystalline structures.	3.5.1	Distinguish between examples of crystalline and noncrystalline substances.
		3.5.2	Form sugar crystals using a concentrated sugar/water solution.
3.6	Know the basic atomic structure of matter.	3.6.1	Describe an atom.
		3.6.2	Draw a simple atom showing its components.

Grade Level: 4

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have a basic understanding of matter and energy.

Objectives	Measures
3.7 Know about elements and compounds.	3.7.1 Give the properties of some common elements.
	3.7.2 Explain the difference between an element and a compound.
3.8 Know the general structure of atoms and molecules.	3.8.1 Distinguish between an atom and a molecule.
	3.8.2 Construct models of a simple atom or molecule using materials such as Styrofoam balls and toothpicks or construction paper.
3.9 Know the general relationship between matter and energy.	3.9.1 Describe how energy can be obtained from matter such as the burning of wood and digestion of food.
	3.9.2 Explain that matter can be recycled but energy cannot.
3.10 Know principles of mechanical energy.	3.10.1 Give a simple description of work.
	3.10.2 List several simple machines such as the lever and inclined plane.
	3.10.3 Describe how some simple machines are used in everyday life.
	3.10.4 Identify a compound machine as two or more machines working together.

Grade Level: 4 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 4: The learner will have a general understanding of the earth's atmosphere, weather, and climate.

Objectives		Measures	
4.1	Know the general composition of air.	4.1.1	Demonstrate that air has weight and occupies space.
		4.1.2	Identify the components of air such as nitrogen, oxygen, carbon dioxide, and water vapor.
4.2	Know about weather and climate.	4.2.1	Identify factors which are important for weather prediction such as temperature, moisture, and atmospheric pressure.
		4.2.2	Explain how factors such as temperature, water, land features, and wind affect climate.
		4.2.3	Recognize major types of clouds.
		4.2.4	Distinguish between weather and climate.

SCIENCE

Grade Level: 4 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 5: The learner will have a general understanding of space.

Objectives	Measures
5.1 Know that the solar system includes the sun and its planets.	5.1.1 Explain that the sun is a star and that it supplies energy to its planets.
	5.1.2 List the names of the planets in order of their distance from the sun.
	5.1.3 Give several characteristics of each of the nine planets.
	5.1.4 Compare the earth and moon in relation to gravity and atmosphere.
5.2 Know about meteors and comets.	5.2.1 Distinguish between a meteor and meteorite.
	5.2.2 Describe a comet.
	5.2.3 Draw and label a picture of a comet.
	5.2.4 Explain some of the folklore about comets.
5.3 Have a general knowledge of the universe.	5.3.1 State some theories of the origin of the universe.
	5.3.2 Describe some major structures found in the universe such as stars and galaxies.
	5.3.3 Identify the North Star, Big Dipper, and Little Dipper.

Grade 5 Outline

1. Introduction

    1.1 What is science
    1.2 How science helps us
    1.3 History of science and scientists
    1.4 Current events

2. Living Things--Plants

    2.1 Basic characteristics
    2.2 Classification of plants
    2.3 What plants need to live and grow
    2.4 Life processes of plants
    2.5 Interdependence of plants and animals
    2.6 Inheritance in plants
    2.7 Economic importance of plants

3. Energy

    3.1 Potential and kinetic energy
    3.2 Sources of energy
    3.3 Forms of energy
    3.4 Uses of energy
    3.5 Relationships between matter and energy
    3.6 Heat sources
    3.7 Temperature measurements
    3.8 Heat transfer
    3.9 Home temperature control
    3.10 Heat engines
    3.11 Conservation
    3.12 Molecular theory of heat

4. Earth Science

    4.1 History of the earth
    4.2 Land and water formations
    4.3 Earth's crust and layers
    4.4 Rocks and minerals
    4.5 Soil and water

5. Environment

    5.1 Natural resources
    5.2 Pollution

SCIENCE

Grade Level: 5 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 1: The learner will understand the nature and relationship of science to human endeavor.

Objectives		Measures	
1.1	Know that science is a way of finding out through observation and experimentation.	1.1.1	Discuss the science process skills (e.g., observing, classifying, measuring, communicating, predicting, interpreting simple data, controlling variables) and how they relate to scientific methods.
		1.1.2	Suggest ways of finding a solution(s) to a given science problem by using scientific methods.
1.2	Know that scientific discoveries help us live better lives.	1.2.1	List several ways scientists' discoveries have improved living conditions for people.
		1.2.2	Discuss how scientists may help solve current environmental problems.
		1.2.3	Suggest ways of reducing food shortages in developing nations.
1.3	Recognize that science is built upon discoveries and contributions made by many people.	1.3.1	Develop a time line for scientific discoveries, add names of male and female scientists from various ethnic groups, and list their discoveries.
		1.3.2	Give a report showing how scientific discoveries, such as penicillin and vitamins, have extended human lives.
1.4	Be aware of current events in science.	1.4.1	Give a report on a new discovery in science.
		1.4.2	Give a report on a recent Nobel Prize-winning scientist.

SCIENCE

Grade Level: 5 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have a general understanding of plants.

Objectives		Measures	
2.1	Know the basic characteristics of plants.	2.1.1	List the basic characteristics of plants.
		2.1.2	Identify major parts of plants.
		2.1.3	Explain how plants are similar and different.
2.2	Know the major classifications of plants.	2.2.1	Identify different plant groups (algae, fungi, mosses, ferns, seed plants).
		2.2.2	List major characteristics of the various plant groups.
		2.2.3	Make brief comparisons of the different plant groups.
2.3	Have a knowledge of plant growth.	2.3.1	Explain the role of sunlight, water, and temperature in the growth of plants.
		2.3.2	List nutrients in the soil that plants use.
		2.3.3	Explain the value of fertilizer.
		2.3.4	Conduct experiments to determine the role of sunlight, water, and temperature on plant growth.
2.4	Have a knowledge of the life processes of plants.	2.4.1	Describe the life cycle of a seed plant.
		2.4.2	Explain the importance of the leaf in food manufacturing.
		2.4.3	Explain the process by which a plant takes up water.
		2.4.4	Explain the role of major plant parts such as roots, stems, leaves, and flowers.

Grade Level: 5

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have a general understanding of plants.

Objectives	Measures
2.5 Know ways plants and animals are interdependent.	2.5.1 Explain why green plants are considered food producers.
	2.5.2 Describe the role of a large tree in a forest community.
	2.5.3 Explain how people and other animals depend on plants for the air they breathe.
2.6 Know how plant characteristics are inherited.	2.6.1 Identify the reproductive parts of flowering plants.
	2.6.2 Explain how traits are inherited.
	2.6.3 Describe how new types of plants have been developed such as hybrid corn and potatoes.
	2.6.4 Explain briefly the work and findings of Gregor Mendel.
2.7 Know the economic importance of plants.	2.7.1 Name and describe products of plants that are used in the building industry, food industry, and clothing industry.
	2.7.2 Describe how plants are used for medicinal purposes.
	2.7.3 Explain the importance of plants in controlling soil erosion.

SCIENCE

Grade Level: 5 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have an understanding of energy, especially heat.

Objectives	Measures
3.1 Know the difference between potential and kinetic energy.	3.1.1 Identify the type of energy involved in a stationary object and in a moving object. 3.1.2 Demonstrate or draw pictures of examples of potential and kinetic energy.
3.2 Have knowledge of several sources of energy.	3.2.1 Indicate that the primary source of energy for the earth is the sun. 3.2.2 List several common sources of energy such as petroleum, wood, wind, sun, and the atom. 3.2.3 Compare and contrast renewable and nonrenewable energy resources used in North Carolina.
3.3 Know about several forms of energy.	3.3.1 List forms of energy such as heat, electrical, mechanical, chemical, radiant (light, x-rays, radar). 3.3.2 List forms of energy involved (chemical, electrical, heat, light) where interaction is occurring such as a "switched-on" flashlight and a burning candle.
3.4 Know several uses of energy.	3.4.1 State several uses of energy such as heating homes, operating machinery, and moving vehicles. 3.4.2 Describe several energy sources for generating electricity such as nuclear, hydroelectric, coal, and petroleum.

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have an understanding of energy, especially heat.

Objectives		Measures	
3.5	Have a general knowledge of matter and energy.	3.5.1	Describe how energy can be obtained from matter such as the burning of wood and digestion of food.
		3.5.2	Explain that matter can be recycled while energy cannot.
		3.5.3	Describe how energy can change matter.
3.6	Know about several sources of heat.	3.6.1	List several sources of heat such as the sun, friction, wood, and gas.
		3.6.2	Compare the various sources of heating for home heating, cooking, and industry.
3.7	Know how to measure temperature.	3.7.1	Measure and record temperature using a thermometer.
		3.7.2	Compare the Fahrenheit and Celsius scales of measuring temperature.
		3.7.3	Discuss different types of temperature measuring devices.
3.8	Have a knowledge of how heat is transferred.	3.8.1	Define conduction, convection, and radiation.
		3.8.2	Demonstrate rate at which heat is conducted through different materials (e.g., wood, glass, steel, aluminum).
3.9	Have a general knowledge of how homes are heated and cooled.	3.9.1	List sources of energy for home heating and air conditioning.
		3.9.2	List ways to conserve energy in heating and cooling.
		3.9.3	Describe several ways of heating a home.

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have an understanding of energy, especially heat.

Objectives	Measures
3.10 Understand the general principles of heat engines.	3.10.1 List uses of steam engines and gasoline engines. 3.10.2 Give a general description of how a heat engine works when given a model or diagram.
3.11 Know the importance of conserving energy in the home, school, and industry.	3.11.1 Describe methods of conserving energy such as insulating, adjusting thermostats, and adjusting the amount of clothing worn. 3.11.2 Compare fuel bills and electric bills over a long period of time to see how energy costs have changed. 3.11.3 Determine what percentage of the total school budget is spent for energy. 3.11.4 Determine the fuel cost for your school for a year.
3.12 Have a general knowledge of heat.	3.12.1 Discuss how heat is the result of molecular motion after experimenting with heat and heating. 3.12.2 Explain how a balloon changes size after being heated.

SCIENCE

Grade Level: 5 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 4: The learner will have a general understanding of earth science.

Objectives		Measures	
4.1	Have a general knowledge of the history of the earth.	4.1.1	Develop a scale of geologic time.
		4.1.2	Explain how fossils are used to study and understand the past.
		4.1.3	Explain how land and oceans have changed over a long period of time.
4.2	Know that the forces changing the earth affect land formation and the formation of bodies of water.	4.2.1	Describe how mountains, valleys, watersheds, wetlands, and oceans are formed.
		4.2.2	Tell ways the earth has changed through natural processes such as climate, weathering, earthquakes, and volcanoes.
		4.2.3	Describe how a particular landform--hills, mountains, valleys, streams, creeks, rivers, wetlands, and others--affects the distribution of plant and animal communities in an area.
4.3	Know about the crust and various layers of the earth.	4.3.1	Label the crust and the various layers of a model of a cross section of the earth.
		4.3.2	Describe the conditions that cause the earth's interior to be hot.

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 4: The learner will have a general understanding of earth science.

Objectives		Measures
4.4 Know about rocks and minerals that compose the earth.	4.4.1	Describe the three basic rock types found in the earth: sedimentary, metamorphic, and igneous.
	4.4.2	Distinguish between rocks and minerals.
	4.4.3	List some important minerals obtained from the oceans.
	4.4.4	Describe how minerals are identified.
	4.4.5	List some economically important rocks and minerals obtained from North Carolina's land.
	4.4.6	Describe ways to minimize the negative environmental effects of mining North Carolina's rocks and minerals.
4.5 Know about soil and water.	4.5.1	Explain how water is an agent of soil formation such as the breaking of rocks.
	4.5.2	Describe how water causes soil erosion.
	4.5.3	Explain the effects of soil erosion and runoff on cropland, wetlands, lakes, rivers, estuaries, and the ocean.
	4.5.4	Explain the economic importance of oceans.

SCIENCE

Grade Level: 5 **Skills/Subject Area:** Elementary Science

COMPETENCY GOAL 5: The learner will understand the nature and conservation of those resources which make up our environment.

Objectives		Measures
5.1 Know about basic natural resources.	5.1.1	Name the various types of forests found in the Southeastern United States.
	5.1.2	Draw a profile of the layers of soil.
	5.1.3	Describe the water cycle.
	5.1.4	Name some of the wildlife found in the Piedmont, coastal plains, and mountains of the State.
	5.1.5	List ways that people in local watersheds (e.g., Cape Fear, Neuse) can share natural resources with the animals and plants.
5.2 Know about the effects of pollution on the environment.	5.2.1	List air pollutants and how they affect the environment.
	5.2.2	Describe how water pollutants affect aquatic life.
	5.2.3	Give some harmful effects of storing hazardous and toxic substances in the soil.
	5.2.4	List hazardous and toxic substances found in and around the home and suggest ways to prevent their getting into the environment.

Grade 6 Outline

1. Introduction
    - 1.1 What is science
    - 1.2 How science helps us
    - 1.3 Economic importance of science
    - 1.4 Careers in science and technology
    - 1.5 Current events

2. Living Things--Humans
    - 2.1 Our bodies: parts and functions
    - 2.2 Care of the body
    - 2.3 Diseases

3. Matter and Energy
    - 3.1 Physical and chemical changes
    - 3.2 Chemical shorthand
    - 3.3 Atomic structure
    - 3.4 Electrical energy and magnetism
    - 3.5 Properties of wave motion

4. Space Exploration
    - 4.1 Rockets
    - 4.2 Satellites
    - 4.3 Space travel
    - 4.4 Benefits to people

5. Ecology
    - 5.1 Populations
    - 5.2 Communities
    - 5.3 Ecosystems

SCIENCE

Grade Level: 6 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 1: The learner will understand the nature and relationship of science to human endeavor.

Objectives	Measures
1.1 Know that science is a way of finding out through observation and experimentation.	1.1.1 Discuss the science process skills (e.g., observing, classifying, measuring, communicating, predicting, interpreting simple data, controlling variables) and how they relate to scientific methods.
	1.1.2 Suggest ways of finding a solution(s) to a given science problem by using scientific methods.
	1.1.3 Suggest ways of solving a social problem such as pollution using scientific methods.
1.2 Know that scientific discoveries help us live better.	1.2.1 List several scientific discoveries which have improved living conditions.
	1.2.2 List current problems such as cancer and heart disease which scientists are investigating.
	1.2.3 Name some scientific discoveries that have improved communications.
1.3 Know that science is economically important.	1.3.1 List ways that science is important to our economy.
	1.3.2 Discuss how scientific inventions such as lasers, computers, and automobiles have affected the economy of the country.

Grade Level: 6

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 1: The learner will understand the nature and relationship of science to human endeavor.

Objectives	Measures
1.4 Know about various careers in science and technology.	1.4.1 Name and describe four careers in science and technology.
	1.4.2 Discuss careers in which science and technology are important such as nursing, auto mechanics, and farming.
	1.4.3 List personal attributes that help a scientist to be successful.
	1.4.4 State the basic education needed to work in various careers in science--high school teaching, engineering, college teaching, and researching.
1.5 Be aware of current events in science.	1.5.1 Give a report on recent discoveries in science.
	1.5.2 Keep a log of science-related news articles for a month.

Grade Level: 6 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 2: The learner will have an understanding of the structure, function, and care of the human body.

Objectives	Measures
2.1 Know about human body systems and their many parts and functions.	2.1.1 Identify the function of major body parts. 2.1.2 Identify major body systems such as digestive, reproductive, circulatory, respiratory, and muscular. 2.1.3 Describe primary functions of the major body systems. 2.1.4 Explain how major body systems interrelate. 2.1.5 Explain how human traits are inherited.
2.2 Know the importance of caring for the body through proper nutrition, health care, and sanitary practices.	2.2.1 Discriminate between good and bad health practices. 2.2.2 Describe how disease-causing organisms enter the body such as through water, food, air, and the skin. 2.2.3 Identify a menu which includes the four basic food groups. 2.2.4 Name and describe several nutritional diseases. 2.2.5 Give a report on immunity.
2.3 Know about human diseases.	2.3.1 Name several diseases caused by microorganisms such as bacteria, viruses, and protozoans. 2.3.2 Name and discuss several diseases caused by parasites. 2.3.3 Name several diseases caused by chemical substances, especially alcohol and lead. 2.3.4 Describe problems caused by genetic abnormalities.

SCIENCE

Grade Level: 6 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have a general understanding of matter and energy.

Objectives	Measures
3.1 Know the general nature of physical and chemical changes.	3.1.1 Distinguish between chemical and physical changes such as the burning of a match and the melting of ice.
	3.1.2 Distinguish between mixtures and compounds.
	3.1.3 Identify substances which are mixtures and compounds.
3.2 Know the shorthand method for representing elements, compounds, and chemical reactions.	3.2.1 Give the symbols for several common elements such as oxygen, hydrogen, helium, iron, and sulfur.
	3.2.2 Give the formulas for several compounds such as sodium chloride, water, and carbon dioxide.
	3.2.3 Write an equation showing a simple chemical reaction such as hydrogen and oxygen forming water, or carbon and oxygen forming carbon dioxide.
3.3 Know about the structure of atoms and molecules.	3.3.1 List the basic components of atoms.
	3.3.2 Draw a diagram that represents the structure of an atom such as helium.
	3.3.3 Draw a diagram that represents the structure of a molecule such as water.

Grade Level: 6

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 3: The learner will have a general understanding of matter and energy.

Objectives	Measures
3.4 Have a general knowledge of electricity and magnetism.	3.4.1 Distinguish between magnetic and nonmagnetic substances.
	3.4.2 Demonstrate that magnetic forces can act through some materials by using magnets and various objects such as glass, wood, and containers of water.
	3.4.3 Demonstrate that electric current produces magnetism when given a battery, wire, and magnetic compass.
	3.4.4 Demonstrate the production of static electricity when given a comb and bits of paper.
	3.4.5 Define electric current.
	3.4.6 Test different materials to determine if they are conductors or nonconductors of electricity, when given a battery, wire, and a flashlight bulb.
3.5 Have a general knowledge of wave phenomena.	3.5.1 Identify wave properties such as reflection and refraction.
	3.5.2 Identify several types of wave phenomena such as light, sound, radio, and water waves.
	3.5.3 Identify sound as being produced by the vibration of objects.
	3.5.4 Determine how far away lightning is by measuring the time between seeing lightning and hearing thunder.
	3.5.5 Create a musical "instrument" and explain how to vary sounds.

SCIENCE

Grade Level: 6 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 4: The learner will have a basic understanding of space exploration.

Objectives	Measures
4.1 Know how the development of rockets contributes to the exploration of space.	4.1.1 Draw and label the major parts of a typical rocket.
	4.1.2 Describe the function of the major parts of a rocket.
	4.1.3 Make and explain a simple balloon rocket.
	4.1.4 Explain why rockets are needed for space travel.
	4.1.5 Distinguish between a rocket engine and a jet engine.
4.2 Know how artificial satellites benefit people.	4.2.1 Describe how a satellite stays in orbit.
	4.2.2 Name different types of satellites and the purpose of each.
	4.2.3 Compare a man-made satellite and the moon.
	4.2.4 Describe how artificial satellites are useful to people.
4.3 Know the history of space travel.	4.3.1 Name the nation that first put a man into space.
	4.3.2 Name the first American in space and the first man to walk on the moon.
	4.3.3 Compare early manned spaceships with those of today.
	4.3.4 Describe the environmental conditions necessary for people to travel in space.

Grade Level: 6

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 4: The learner will have a basic understanding of space exploration.

Objectives	Measures
4.4 Know benefits that have come from space exploration.	4.4.1 Explain how space exploration has contributed to faster communication.
	4.4.2 Make a report on NASA.
	4.4.3 List by-products obtained from space exploration that are beneficial to people.

Grade Level: 6 Skills/Subject Area: Elementary Science

COMPETENCY GOAL 5: The learner will have a basic understanding of ecology.

Objectives		Measures
5.1 Know the basic characteristics of a population.	5.1.1	Identify various populations that may be found in a certain area such as oak trees in a forest, rabbits in a field, or frogs in a pond.
	5.1.2	Describe the functions of the worker, drone, and queen in a bee population.
	5.1.3	Compare a population of fish with a population of rabbits for similarities and differences.
	5.1.4	Describe the growth of a population over a period of time and some limiting factors.
5.2 Know about the interaction of individuals in a community.	5.2.1	Name the food producers and the consumers found in a community.
	5.2.2	Diagram a food chain beginning with grass and ending with humans.
	5.2.3	Diagram a food web that includes such organisms as grass, insects, people, rabbits, hawks, and earthworms.
	5.2.4	Compare two plant communities.
	5.2.5	List exotic plants and animals that have invaded North Carolina.
	5.2.6	Prepare a map of North Carolina showing the general location of threatened and endangered plants and animals.
	5.2.7	Suggest reasons for trying to save populations of threatened and endangered plants and animals.

Grade Level: 6

Skills/Subject Area: Elementary Science

COMPETENCY GOAL 5: The learner will have a basic understanding of ecology.

Objectives	Measures
5.3 Know about ecosystems.	5.3.1 Identify the major living and nonliving components of a typical ecosystem.
	5.3.2 Name the basic components of a freshwater ecosystem.
	5.3.3 Describe how soil organisms obtain their energy.
	5.3.4 Trace the flow of energy in a food chain (sun grass rabbit hawk microorganisms).
	5.3.5 Compare saltwater and freshwater ecosystems.
	5.3.6 Describe a simple, closed terrarium.
	5.3.7 Describe ways that people affect nutrient supplies in various natural ecosystems (particularly aquatic).

GRADES 7-8

Major Emphases

The middle grades science curriculum is characterized by the study of basic life, earth, and physical science concepts. Skills and concepts introduced in the lower grades are further extended and developed. For the first time, the student is introduced to an in-depth, year-long course of integrated science.

The curriculum reflects the nature of the middle grade learner. Consideration is given to the developmental stages (physical and cognitive) of students and the need for experiencing abstract science through concrete learning activities. This implies that instruction should be directed to individuals as well as groups. This also implies that instruction should be largely laboratory-centered with stress on scientific methods through application of scientific process skills. The development of problem solving and reasoning skills is an essential part of the process. Inquiry methods are used to deal with real world problems that are socially and personally relevant. Emphasis is placed upon the use of the integrative processes of science: controlling variables, formulating hypotheses, interpreting data, and designing experiments.

Personal needs, societal issues, and academic and career preparation are woven into the course content. The methods for doing this will vary among schools and teachers. Energy, environmental concerns, and recent advances in science and technology also permeate the curriculum.

In summary, the middle grades science program:

- builds and further develops basic skills and concepts introduced in elementary grades.
- provides concrete experiences with emphasis on problem-solving and logical reasoning.
- provides an integrated exploratory approach which covers earth, physical, and life sciences.
- emphasizes career exploration in the sciences and technology.
- provides for interaction with other disciplines.
- provides decision-making opportunities so students can evaluate personal and societal implications of science and technology.

- provides opportunities for the use of local resources (zoos, science centers, museum specialists).
- makes use of current technology (microcomputers, television, calculators).

Grade 7 Outline

1. Science and Its Relationship to Human Endeavor

    1.1 The nature of science
    1.2 Laboratory safety
    1.3 Recent advances in science and technology
    1.4 Science-related careers--overview
    1.5 Measurement
    1.6 Current societal issues related to science

2. The Scope of Life Science

    2.1 Major components of life science
    2.2 Differences between living and nonliving things

3. Human Growth and Development

    3.1 Organization of the body
    3.2 Human growth patterns

4. Organization and Variety of Living Things

    4.1 Cells
    4.2 Hierarchy (cells to organisms)
    4.3 Major types
    4.4 Characteristics of plants and animals
    4.5 Characteristics of protists, fungi, and monerans

5. Plant and Animal Communities

    5.1 Populations
    5.2 Energy flow
    5.3 Limiting factors
    5.4 Interaction of people and the environment

6. The Scope of Earth Science

    6.1 Components of earth science
    6.2 Earth as a moving body in space
    6.3 Mapping of the earth

7. Earth Forms and Natural Phenomena

    7.1 Minerals
    7.2 Rocks
    7.3 Weathering
    7.4 Soils

    7.5 Hydrologic cycle
    7.6 Oceans
    7.7 Shorelines

8. Meteorology and Climatology

    8.1 Structure of the atmosphere
    8.2 Role of the sun
    8.3 Energy and atmospheric circulation
    8.4 Cloud formation and precipitation
    8.5 Nature of climate
    8.6 Physical factors that affect climate
    8.7 Climate types

9. Astronomy and Space Exploration

    9.1 Solar system
    9.2 Historical space events

10. The Scope of Physical Science

    10.1 Components of physical science
    10.2 The need to study physical science

11. Chemical Phenomena

    11.1 Atom
    11.2 Atomic structure
    11.3 Compounds and mixtures
    11.4 Chemical reactions

12. Physical Phenomena

    12.1 Measurement
    12.2 Work
    12.3 Machines
    12.4 Power
    12.5 Magnetism
    12.6 Heat

SCIENCE

Grade Level: 7 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 1: The learner will understand the nature and relationship of science to human endeavor.

Objectives	Measures
1.1 Know the nature of science.	1.1.1 Define science. (Science is a tentative body of knowledge as well as a process of acquiring new knowledge.)
	1.1.2 Cite examples that show that the scientific process generates knowledge.
	1.1.3 List major steps in scientific research.
	1.1.4 Demonstrate the use of the scientific processes involved in a simple experiment (e.g., observing, measuring, predicting, communicating, interpreting data, controlling variables, formulating hypotheses).
	1.1.5 Demonstrate the ability to use scientific methods while solving a problem.
	1.1.6 Match broad areas of science to their descriptors (e.g., earth science--the study of the earth and its environment).
	1.1.7 Present a report on a major area of science.
	1.1.8 Give examples of how various areas of science interrelate.
	1.1.9 List examples of how science has affected society and human health.

Grade Level: 7

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 1: The learner will understand the nature and relationship of science to human endeavor.

Objectives	Measures
1.2 Be aware of the importance of laboratory safety.	1.2.1 List major safety rules for the laboratory.
	1.2.2 Identify basic safety equipment and materials.
	1.2.3 Practice laboratory safety while in the laboratory.
	1.2.4 Create a poster that demonstrates a safety rule or hazard.
1.3 Be aware of current advances in science and technology.	1.3.1 Make a report from examples in the media, citing recent advances in science and technology.
	1.3.2 Describe the pros and cons of recent advances in science.
1.4 Know that there are many varied careers in science.	1.4.1 Give examples of careers in earth science, life science, and physical science.
	1.4.2 Give examples of nonscience careers that require scientific knowledge and methodology.
1.5 Know that science depends on accurate measurement.	1.5.1 Use metric units of length, mass, volume, and temperature when given measurement problems.
	1.5.2 Demonstrate precision and accuracy in measurement during assigned investigations.

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 1: The learner will understand the nature and relationship of science to human endeavor.

Objectives	Measures
1.6 Know current societal issues related to science.	1.6.1 Cite several science issues or discoveries that are in the news using current newspapers, magazines, journals, and TV programs.
	1.6.2 Discuss several current, controversial issues in science.

SCIENCE

Grade Level: 7 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 2: The learner will have a general understanding of the scope of life science.

Objectives	Measures
2.1 Know the major components of life science.	2.1.1 State the nature of life science (the study of living things).
	2.1.2 List major branches of life science (zoology, botany, genetics, microbiology, physiology, and anatomy).
2.2 Know differences between living and nonliving things.	2.2.1 Give several characteristics of living and nonliving things.
	2.2.2 Explain the difference between "dead" and "nonliving."

SCIENCE

Grade Level: 7 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 3: The learner will have an understanding of human growth and development.

Objectives	Measures
3.1 Know that the human body is composed of various interacting systems with specific structures and functions.	3.1.1 Name the major organ systems of the human body using a model, chart, or drawing.
	3.1.2 Give the main function of each of the systems of the human body.
	3.1.3 Choose two or more organ systems and tell how they are interrelated in regard to one characteristic or function. (The respiratory system obtains oxygen, the circulatory system delivers oxygen, and the muscular system uses oxygen in energy production for locomotion.)
3.2 Know the basic characteristics of human growth patterns.	3.2.1 Name and give some characteristics of the periods associated with the normal life span of humans.
	3.2.2 Name some factors that affect growth and maturation in humans (e.g., heredity, nutrition, environmental factors).

SCIENCE

Grade Level: 7 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 4: The learner will have an understanding of the organization and variety of life forms.

Objectives	Measures
4.1 Know that the basic unit of life is the cell.	4.1.1 Identify the cell as the basic unit of structure and function in living things.
	4.1.2 Identify major cell structures and describe their functions.
	4.1.3 Name some structures found in plant cells and not in animal cells (e.g., plastids, chloroplasts, leucoplasts, cell walls).
	4.1.4 Name and discuss major contributions of some cell biologists.
4.2 Know the hierarchical design of organisms: cells, tissues, organs, and systems.	4.2.1 Define and sequence the terms: organs, tissues, cells, and systems.
	4.2.2 Name the organs associated with the major body systems.
	4.2.3 Explain why complex organisms must have organs and systems.
4.3 Know that there are many types of living things.	4.3.1 Name several living things and classify them as plants, animals, protists, monerans, or fungi.
	4.3.2 Tell why taxonomic systems are important for human understanding.
	4.3.3 Arrange a list of organisms in proper sequence from most simple to most complex.

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 4: The learner will have an understanding of the organization and variety of life forms.

Objectives	Measures
4.4 Know similarities and differences in plants and animals.	4.4.1 Name some characteristics that are common among plants but not animals.
	4.4.2 Name some characteristics that are common among animals but not plants.
	4.4.3 Give some basic life functions that are much the same in plants and animals.
4.5 Have a general knowledge of the protists, fungi, and monerans.	4.5.1 Describe how protists, fungi, and monerans differ from plants and animals (e.g., have no tissues).
	4.5.2 Name the general kinds of protists (e.g., bearers of cilia, flagella, and psuedopods).
	4.5.3 Name the general kinds of fungi (e.g., yeasts, molds, and mushrooms).
	4.5.4 Name the general kinds of monerans (e.g., bacteria and blue-green algae).
	4.5.5 Name some major contributions of protists, fungi, and monerans to the biosphere (e.g., decompose organic matter, fix nitrogen, and purify sewage).

SCIENCE

Grade Level: 7 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 5: The learner will have an understanding of plant and animal **communities.**

Objectives		Measures	
5.1	**Know that a community is made up of interacting populations.**	5.1.1	**Define and describe a population.**
		5.1.2	**Identify the organisms present in a given community and classify each according to the role it plays: producer, consumer, decomposer.**
		5.1.3	**Describe the effects of a major stress on a community.**
		5.1.4	**List some major factors associated with all communities. (Response should include examples of interrelationships.)**
5.2	**Know that a community must have an energy source and nutrient sources.**	5.2.1	**Describe how energy from the sun is captured by green plants, moves through the community, and is ultimately lost to the surrounding environment (and space) as heat.**
		5.2.2	**Write a report supporting the principle that the major source of energy for a community is the sun.**
		5.2.3	**Describe how nutrients cycle within an ecosystem providing raw materials for the community.**
5.3	**Know that communities are affected by limiting factors.**	5.3.1	**Define limiting factor (e.g., any abiotic or biotic resource that is scarce relative to the demand for it).**
		5.3.2	**Tell how water, light, temperature, and oxygen set limits for a particular population.**

Grade Level: 7

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 5: The learner will have an understanding of plant and animal communities.

Objectives	Measures
5.4 Know that people interact with the environment and produce change.	5.4.1 List several ways that the natural environment has been changed by people.
	5.4.2 List and describe several societal factors that impact on the natural resources (e.g., overpopulation, industrial pollution, noise pollution, rationing).

SCIENCE

Grade Level: 7 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 6: The learner will have a general knowledge of earth science.

Objectives		Measures	
6.1	Be aware that earth science is a varied group of sciences employing many techniques to investigate the earth.	6.1.1	Explain the nature of studies in astronomy, geology, meteorology, climatology, and oceanography.
		6.1.2	Prepare a poster with photographs and descriptions that show how the various branches of the earth sciences relate to one another.
		6.1.3	Discuss reasons why the study of earth science is important.
		6.1.4	List and describe careers related to earth science.
		6.1.5	Give examples of problems related to earth science such as building earthquake-resistant structures and dealing with violent weather.
6.2	Know that the earth is a body moving through space.	6.2.1	Give evidence of the earth's motion in space.
		6.2.2	Use a model to demonstrate the earth's rotation on its axis and explain how day and night result from that motion.
		6.2.3	Demonstrate how seasons result from the motion of the earth about the sun.

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 6: The learner will have a general knowledge of earth science.

Objectives	Measures
6.3 Know how the earth's surface is mapped.	6.3.1 Provide evidence that the earth is essentially a sphere (e.g., satellite photographs, earth's shadow on the moon).
	6.3.2 Demonstrate the usefulness of the earth's magnetic field location and mapping.
	6.3.3 Use a globe or sphere to show how the system of longitude is established.
	6.3.4 Show how time is determined using the earth's rotation (e.g., 15° longitudinal rotation equals one hour of time).
	6.3.5 Use a globe or sphere to explain how the earth is divided into lines of latitude. (The measurement begins at the equator and increases to 90°, both north and south.)
	6.3.6 Show how maps serve as graphic models of the earth.

SCIENCE

Grade Level: 7 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 7: The learner will understand earth forms and natural phenomena.

Objectives	Measures
7.1 Have knowledge of minerals.	7.1.1 Describe several basic properties of minerals (e.g., hardness, malleability, luster).
	7.1.2 Identify/describe several common rock-forming minerals (e.g., quartz found in granite, feldspar found in gneiss).
7.2 Know how the structure, texture, and composition of rocks reflect their origin and history.	7.2.1 Describe the formation of igneous rock. (Different crystalline structures form depending on the rate of cooling.)
	7.2.2 Recognize several common types of igneous rock and indicate their relative cooling rates by comparing their crystalline structures.
	7.2.3 Describe the principal landforms resulting from igneous processes (e.g., volcanic mountains and islands).
	7.2.4 Illustrate the formation of sedimentary rock by layering different types of soil and sand.
	7.2.5 Recognize several common types of sedimentary rock and describe the conditions under which they formed. (Sandstone forms when sand from rivers and beaches is deposited and later covered by other materials.)
	7.2.6 Explain why fossils are found in sedimentary rock and not in igneous rock.
	7.2.7 Describe two principal factors in the formation of metamorphic rock.

Grade Level: 7

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 7: The learner will understand earth forms and natural phenomena.

Objectives	Measures
7.3 Know how minerals and rocks respond to weathering.	7.3.1 Explain the difference between physical and chemical weathering, and give examples of each.
	7.3.2 Explain processes that cause physical weathering.
	7.3.3 Describe several common chemical weathering reactions (e.g., the dissolving of features on marble statues exposed to rain).
7.4 Know how soil forms from weathered rock.	7.4.1 Define a mature soil and explain its formation as exhibited by various horizons.
	7.4.2 Demonstrate some of the physical properties of soil such as moisture, color, and texture.
	7.4.3 Identify and compare physical characteristics of local soil samples.
	7.4.4 Demonstrate the perk test to determine whether a soil is suitable for a septic tank drainfield (related to porosity and permeability).

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 7: The learner will understand earth forms and natural phenomena.

Objectives		Measures	
7.5	Have knowledge of the hydrologic cycle.	7.5.1	Diagram the hydrologic cycle.
		7.5.2	Describe several sources of water vapor entering the hydrologic cycle such as plant transpiration and evaporation from surface water.
		7.5.3	Describe the basic structure of water tables and related features such as springs, lakes, and swamps.
		7.5.4	Explain how water moves through the earth and describe the basic concept of permeability.
		7.5.5	Explain problems associated with water shortages.
		7.5.6	Identify the many users (people, plants, animals) of water resources within the surrounding watershed.
7.6	Know that oceanography employs various scientific disciplines.	7.6.1	Describe how several different scientific disciplines are applied to the study of oceans.
		7.6.2	Describe some of the topics typically studied by oceanographers (e.g., waves, currents, and climate modification).
		7.6.3	Give reasons why oceanography is important to contemporary societies.

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 7: The learner will understand earth forms and natural phenomena.

Objectives	Measures
7.7 Know that shorelines are continually changing environments.	7.7.1 Provide examples of how coastal landscapes are changed by waves, tides, currents, and winds (e.g., longshore currents moving sandbars, barrier islands, and inlets).
	7.7.2 Give examples of several efforts to control shorelines such as sea walls and jetties, and explain how natural systems have responded.
	7.7.3 Describe how water waves are generated, travel, and break, thereby transferring energy to shorelines.
	7.7.4 Describe the general landform characteristics of neutral, submerged, and emergent shorelines.

Grade Level: 7 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 8: The learner will understand the nature of weather and climate.

Objectives	Measures
8.1 Have knowledge of the earth's atmosphere.	8.1.1 List the major gases of the atmosphere and identify their relative abundance.
	8.1.2 Describe the troposphere and the stratosphere. (The troposphere is where our weather occurs and the stratosphere shows an increase in temperature with an increase in altitude.)
	8.1.3 Describe people-induced changes in the composition of the atmosphere and possible consequences.
8.2 Know that energy from the sun is responsible for most of the processes on earth.	8.2.1 Interpret a diagram depicting the balance of incoming solar radiation and outgoing longwave radiation; include effects of clouds, atmosphere components, and various surface features.
	8.2.2 Discuss some of the processes on earth that are affected by the sun such as photosynthesis, photoperiodism, vision, and weather patterns.
8.3 Know about the relationships between solar energy and atmospheric circulation.	8.3.1 Demonstrate that air movement is caused by heating and cooling.
	8.3.2 Explain, by use of a diagram, how unequal distribution of solar energy affects the general circulation in the atmosphere.
	8.3.3 Show how weather systems move across the earth's surface using a standard weather map.
	8.3.4 Explain the phenomenon of local breezes such as sea and land breezes.

Grade Level: 7

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 8: The learner will understand the nature of weather and climate.

Objectives		Measures	
8.4	Have knowledge of cloud formation and the production of precipitation.	8.4.1	Demonstrate and explain the processes of condensation and vaporization.
		8.4.2	Describe the processes of cloud formation.
		8.4.3	Describe the various physical conditions such as terrain and surface heating that cause variation in vertical air motion.
		8.4.4	Using data presenting average precipitation for various locations in North Carolina, explain why some areas of the State receive more precipitation than other areas.
8.5	Have knowledge of the nature of climates.	8.5.1	Explain the difference between weather and climate.
		8.5.2	Give examples of weather phenomena that are repeated periodically forming a climatic zone.
8.6	Know physical factors that affect climates.	8.6.1	Give examples of climates that are altered by landforms and ocean currents.
		8.6.2	Describe the effect of major ocean currents on the climate of adjacent land areas. (The United States Southeast's coastal region is warmed by the Gulf Stream.)
		8.6.3	Predict the probable climate of an area when given a list of geographic characteristics.

Grade Level: 7 Page 3

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 8: The learner will understand the nature of weather and climate.

Objectives	Measures
8.7 Know that different climate types exist in various places on the earth.	8.7.1 Describe major world climates.
	8.7.2 Describe ways in which humans are affecting climate and the possible consequences.
	8.7.3 Cite climatic factors which influence the distribution of people throughout the United States.
	8.7.4 List ways that climatic factors are economically important to people.
	8.7.5 Explain how climates affect soils and soil formation.

SCIENCE

Grade Level: 7 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 9: The learner will have a general understanding of the study of astronomy and space exploration.

Objectives		Measures	
9.1	Know major bodies of the solar system.	9.1.1	Name the major bodies of the solar system.
		9.1.2	List similarities and differences among the planets.
		9.1.3	Make an illustration or model showing the order of planets from the sun.
		9.1.4	Make an illustration or model showing relative sizes and major features of the sun and planets.
		9.1.5	Demonstrate the relative distances of each planet from the sun. (Use students standing apart from each other to represent the sun and planets.)
9.2	Be aware of principal events in the history of space exploration.	9.2.1	Describe several major events such as the first man in space.
		9.2.2	Explain several problems encountered in space exploration and tell how they were solved.
		9.2.3	Name several examples of technological advances developed for space exploration that are now used in everyday life.
		9.2.4	Discuss several problems involved in supporting life in space.
		9.2.5	Recount several of the discoveries made during the manned exploration of the moon. (The moon has moonquakes and its surface dust is relatively thin.)

SCIENCE

Grade Level: 7 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 10: The learner will understand the nature of physical science.

Objectives	Measures
10.1 Know about the subdivisions of physical science.	10.1.1 List and define some of the broad areas of physical science.
	10.1.2 Make a presentation on one of the subdivisions of physical science.
10.2 Know why the study of physical science is important.	10.2.1 List reasons why the study of physical science is important.
	10.2.2 List several careers that are related to physical science.

SCIENCE

Grade Level: 7 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 11: The learner will understand basic phenomena related to chemistry.

Objectives	Measures
11.1 Know that all matter is composed of basic units called atoms.	11.1.1 Identify the atom as the smallest particle of an element that has the properties of that element.
	11.1.2 Describe techniques scientists use to gain knowledge about things too small to be seen.
11.2 Know the general atomic structure of matter.	11.2.1 Draw or construct models of some elements that show electron, proton, and neutron positions.
	11.2.2 Describe electron, proton, and neutron.
11.3 Have knowledge of compounds and mixtures.	11.3.1 Identify a given list of substances as compounds, mixtures, or elements.
	11.3.2 Demonstrate the separation of a mixture.
11.4 Have knowledge of how chemicals react.	11.4.1 Explain the Law of Conservation of Matter and give specific examples.
	11.4.2 Identify from a given chemical reaction the reactant(s) and the product(s), e.g., hydrogen + oxygen -- water. (reactant) (product)
	11.4.3 Name several examples of chemical reactions.
	11.4.4 State that heat affects the rate of chemical reactions.

SCIENCE

Grade Level: 7 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 12: The learner will understand basic phenomena related to physics.

Objectives	Measures
12.1 Know how to use units of metric measurement.	12.1.1 Measure objects using metric units of length, mass, and volume.
	12.1.2 Define and measure a force in newtons.
12.2 Know how work is defined and calculated.	12.2.1 Define and measure work in newton-meters.
	12.2.2 Calculate work done in a given problem.
12.3 Know that machines are devices that assist in doing work.	12.3.1 Draw and identify six simple machines (e.g., lever, pulley, wheel and axle, screw, wedge, and inclined plane).
	12.3.2 Demonstrate how simple machines assist in doing work and give examples.
12.4 Know how power is defined and calculated.	12.4.1 Define power and give examples.
	12.4.2 Calculate power when given a simple work problem: (Power = $\frac{\text{work}}{\text{time}}$).
12.5 Have knowledge of magnetism.	12.5.1 Demonstrate and explain magnetic lines of force.
	12.5.2 Draw a model showing orientation of atoms in a magnet.
	12.5.3 Explain why dropping or heating a magnet can destroy its magnetism.

Grade Level: 7

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 12: The learner will understand basic phenomena related to physics.

Objectives	Measures
12.6 Have knowledge of the nature of heat.	12.6.1 Define heat.
	12.6.2 Identify conduction, convection, and radiation when given a list of specific examples of heat transfer.
	12.6.3 Demonstrate examples of heat transfer by conduction, convection, and radiation, and explain what is occurring.
	12.6.4 Describe changes in heat energy that occur when a substance changes its state.
	12.6.5 Record and interpret temperature-time data when ice changes to water.
	12.6.6 Define expansion and contraction and give examples of each.

Grade 8 Outline

1. Science and Its Relationship to Human Endeavors
    - 1.1 Scientific methods
    - 1.2 Laboratory safety
    - 1.3 History
    - 1.4 Recent advances in science and technology
    - 1.5 Science-related careers--overview
    - 1.6 Measurement
    - 1.7 Current societal issues related to science
2. Adaptation
    - 2.1 Reproduction
    - 2.2 Heredity and DNA
    - 2.3 Asexual and sexual reproduction
    - 2.4 Behavior
    - 2.5 Methods of adaptation
    - 2.6 Changes through time
3. Ecology
    - 3.1 Energy systems
    - 3.2 Communities
    - 3.3 Ecosystems
    - 3.4 Cycles
    - 3.5 People and the environment
4. Land and Sea
    - 4.1 Erosion
    - 4.2 Tectonic forces
    - 4.3 Rock formation
    - 4.4 Geologic time
    - 4.5 Uniformitarianism
    - 4.6 Fossil records
    - 4.7 Ocean currents
    - 4.8 Oceanic topography
5. Space Exploration and the Universe
    - 5.1 Rockets
    - 5.2 Satellites
    - 5.3 Deep space probes

6. Nuclear Energy

    6.1 Isotopes
    6.2 Radioactivity
    6.3 Nuclear fission and fusion
    6.4 Applications of radioactive isotopes
    6.5 Radiation safety

7. Chemical Phenomena

    7.1 Periodic table of elements
    7.2 Chemical shorthand
    7.3 Organic chemistry

8. Physical Phenomena

    8.1 Definition of energy
    8.2 Conservation of energy
    8.3 Movement of energy
    8.4 Properties of light
    8.5 Properties of sound
    8.6 Static electricity
    8.7 Measurement of electric currents
    8.8 Series and parallel circuits
    8.9 Electric power

SCIENCE

Grade Level: 8 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 1: The learner will understand the nature and relationship of science to human endeavor.

Objectives		Measures	
1.1	Know the importance of scientific methods as a way of solving problems.	1.1.1	List major steps in scientific research.
		1.1.2	Demonstrate the ability to use scientific methods while solving a problem.
1.2	Be aware of the importance of laboratory safety.	1.2.1	List major safety rules for the laboratory.
		1.2.2	Identify basic safety equipment and materials.
		1.2.3	Practice laboratory safety while in the laboratory.
1.3	Have a general knowledge of the historical development of science.	1.3.1	List at least six major historical scientists and their discoveries.
		1.3.2	Give an example of how one discovery led to another discovery in scientific history.
		1.3.3	Give an example of an accidental scientific discovery of major importance (e.g., discovery of penicillin).
1.4	Be aware of current advances in science and technology.	1.4.1	Make reports from examples in the media, citing recent advances in science and technology.
		1.4.2	Describe the pros and cons of recent advances in science.
1.5	Be aware of the many varied careers in science.	1.5.1	Give examples of careers in earth science, life science, and physical science.
		1.5.2	Give examples of nonscience careers that require scientific knowledge and methodology.

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 1: The learner will understand the nature and relationship of science to human endeavor.

Objectives		Measures
1.6 Know that science depends on accurate measurement.	1.6.1	Use metric units of length, mass, volume, and temperature when given measurement problems.
	1.6.2	Demonstrate precision and accuracy in measurement during assigned investigations.
1.7 Know that many current issues in science affect society.	1.7.1	Cite current issues in science using newspapers, magazines, and TV programs.
	1.7.2	Describe science issues that may be cause for controversy.
	1.7.3	Identify science issues of local concern.

SCIENCE

Grade Level: 8 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 2: The learner will have an understanding of adaptation and its significance as a characteristic of life.

Objectives		Measures	
2.1	Know that all life comes from life through the process of reproduction.	2.1.1	Explain what is meant by the term, "life comes from life."
		2.1.2	Describe an experiment that has been done in support of "life comes from life."
2.2	Know that the basis of inheritance is DNA.	2.2.1	Define DNA and give its role in heredity.
		2.2.2	Describe how genes allow organisms to vary.
		2.2.3	Define mutation and give factors that cause mutations.
2.3	Have a general knowledge of asexual and sexual reproduction.	2.3.1	Define sexual and asexual reproduction and give examples of each.
		2.3.2	Describe the process of mitosis.
		2.3.3	Describe the process of meiosis.
2.4	Know that organisms respond to stimuli.	2.4.1	Name several examples of plant responses to stimuli.
		2.4.2	Give some characteristics of each of the following kinds of behavior: aggression, warning, marking, offspring identification, courtship.
2.5	Know about adaptation.	2.5.1	Choose several animals and plants and identify adaptations which enable them to survive.
		2.5.2	Give several features that an organism must have to adapt to a specific environment.

Grade Level: 8

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 2: The learner will have an understanding of adaptation and its significance as a characteristic of life.

Objectives	Measures
2.6 Know that organisms have undergone changes through time.	2.6.1 Explain the meaning of the expression, "survival of the most fit."
	2.6.2 Describe how changes gradually appear within species.

SCIENCE

Grade Level: 8 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 3: The learner will have a general understanding of ecology.

Objectives		Measures	
3.1	Have a general knowledge of how energy is obtained and transferred in a community.	3.1.1	Describe how energy from the sun is captured by producers and transformed into chemical energy.
		3.1.2	Outline a food chain or a food web using a list of organisms or a picture of a community, showing the proper sequence of the flow of energy from producer to decomposers.
		3.1.3	Describe the probable consequences to a given community when one population is either increased or decreased.
3.2	Know how communities vary.	3.2.1	List ways that freshwater, marine, and terrestrial communities are both similar and different.
		3.2.2	Give characteristics of some common communities.
3.3	Have knowledge of ecosystems.	3.3.1	Define ecosystem.
		3.3.2	Name abiotic and biotic factors that are common to communities.
		3.3.3	Explain the expression, "spaceship earth."
3.4	Know the basic cycles of materials that occur in ecosystems.	3.4.1	State the major cycles of ecosystems (e.g., water, nitrogen, carbon).
		3.4.2	Explain how material cycles are altered by societal activities.

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 3: The learner will have a general understanding of ecology.

Objectives	Measures
3.5 **Know that people interact with the environment and produce change.**	3.5.1 Identify ways that overpopulation and pollution disrupt ecosystems.
	3.5.2 Write a report that describes some ways by which natural resources may be conserved.
	3.5.3 Prepare a list of ways by which the natural environment has been changed by developments of human societies.

SCIENCE

Grade Level: 8 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 4: The learner will have an understanding of some processes that shape the land and sea.

Objectives	Measures
4.1 Have knowledge of erosion.	4.1.1 Prepare a display of pictures that show several examples of gravity moving material downhill.
	4.1.2 Describe and illustrate stream features and erosion processes in youthful, mature, old age, and rejuvenated streams.
	4.1.3 Describe several features and processes related to wind erosion.
	4.1.4 Describe several features and processes related to glacial erosion.
	4.1.5 List techniques people can use to reduce soil erosion caused by wind and water.
4.2 Know about the theory of plate tectonics.	4.2.1 Explain the principal evidence for tectonics.
	4.2.2 Demonstrate and describe several ways in which rocks respond to deformational forces.
	4.2.3 Show that motion along faults produces earthquakes and describe them.
	4.2.4 Illustrate characteristics of landforms created by tectonic activity such as mountain ranges and deep-sea trenches.
4.3 Know how igneous, sedimentary, and metamorphic rocks are formed.	4.3.1 Describe how igneous, sedimentary, and metamorphic rocks are formed.
	4.3.2 Create a display of igneous, sedimentary, and metamorphic rocks.
	4.3.3 List two examples of each rock type which is economically important in North Carolina.

Grade Level: 8

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 4: The learner will have an understanding of some processes that shape the land and sea.

Objectives	Measures
4.4 Know about changes in landforms over long periods of geologic time.	4.4.1 Show the differences in youthful, mature, and old age landforms.
	4.4.2 Describe how various landforms change over geologic time.
	4.4.3 Describe the geologic history of the State and local regions.
	4.4.4 Using a topographic map of the local region, list the kinds of landform features found there.
4.5 Have knowledge of the theory of uniformitarianism.	4.5.1 Explain how geologic time is measured.
	4.5.2 Explain the basic rules on which the relative ordering of geologic events are based.
	4.5.3 Tell about methods used to date rocks.
4.6 Know how geologic and fossil records reflect the earth's history.	4.6.1 Describe general evidence for the orderly development of life forms.
	4.6.2 Construct a model of the geologic time scale, showing the duration of human life.
	4.6.3 Discuss probable causes for extinction of various species.
	4.6.4 State the rate of extinction of species now compared to the rate of extinction of species before people dominated the earth. [Note: modern rate = one species/year; natural rate (before human dominance) = one species/thousand years.]

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 4: The learner will have an understanding of some processes that shape the land and sea.

Objectives		Measures	
4.7	Have knowledge of the basic causes and patterns of ocean circulation.	4.7.1	Identify major ocean currents and their characteristics.
		4.7.2	Name several forces responsible for currents.
		4.7.3	Explain ocean tides using models of the earth, moon, and sun.
4.8	Know that the topography of ocean basins is rugged and varied.	4.8.1	Locate and identify the world's major oceans on a map.
		4.8.2	Identify the major embayments (sounds) along the North Carolina coast.
		4.8.3	Identify and describe the major types of submarine features found in the ocean basins such as ridges, trenches, and continental shelves.

Grade Level: 8 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 5: The learner will understand some of the basic principles of space exploration.

Objectives	Measures
5.1 Know the basic principles on which rockets operate.	5.1.1 Describe the physical laws under which rockets function.
	5.1.2 Demonstrate a "rocket flight" using balloons guided on a string.
5.2 Know how satellites can be used to benefit people.	5.2.1 Explain several ways in which satellites may be applied to the study of the earth including the areas of weather and land resources.
	5.2.2 Explain how satellites are used for communication.
5.3 Know about deep space probes and information obtained from them.	5.3.1 Explain several advantages and disadvantages of space probes as opposed to manned exploration.
	5.3.2 Recount several historical space probes and their accomplishments.

SCIENCE

Grade Level: 8 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 6: The learner will have a general understanding of nuclear energy.

Objectives	Measures
6.1 Know that isotopes are forms of elements whose atoms differ only by atomic mass.	6.1.1 Diagram and label the parts of an atom of the isotopes protium, deuterium, and tritium.
	6.1.2 Report on isotopes of carbon.
6.2 Know that the nuclei of radioactive elements undergo spontaneous change.	6.2.1 Describe alpha, beta, and gamma radiation.
	6.2.2 Name some common sources of nuclear radiation.
	6.2.3 Identify at least three ways radiation is detected (e.g., photography, heat, Geiger counter, solar-powered calculator).
6.3 Know about the processes of nuclear fission and fusion.	6.3.1 Compare and contrast the processes of nuclear fission and fusion, and provide an example of each.
	6.3.2 Write a paper on the possible outcomes of a breakthrough in fusion research.
6.4 Be aware of useful applications of radioactive isotopes.	6.4.1 Debate the pros and cons of nuclear power.
	6.4.2 List useful applications of radioactive isotopes in areas such as industry, medicine, and agriculture.
6.5 Know the necessity for protection against nuclear radiation.	6.5.1 List the three factors to be considered when protecting oneself from exposure to radiation: time, distance, intensity.
	6.5.2 State the precautions required to shield oneself from alpha, beta, and gamma radiation.

SCIENCE

Grade Level: 8 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 7: The learner will understand basic phenomena related to chemistry.

Objectives	Measures
7.1 Know about the periodic table of elements.	7.1.1 Describe characteristics of the periodic table.
	7.1.2 Describe characteristics of a chemical family.
7.2 Know about chemical symbols for elements, formulas, and equations.	7.2.1 List symbols and/or formulas for elements and compounds.
	7.2.2 Write simple chemical equations.
7.3 Know that organic chemistry is the study of carbon and its compounds.	7.3.1 List examples of common organic compounds (e.g., rayon and other synthetic fibers, petroleum, sugar, fats, soap).
	7.3.2 Describe how coal, petroleum, and natural gas are believed to have formed.

SCIENCE

Grade Level: 8 Skills/Subject Area: Integrated Science

COMPETENCY GOAL 8: The learner will understand basic phenomena related to physics.

Objectives	Measures
8.1 Know that energy is the ability to do work.	8.1.1 Distinguish between potential and kinetic energy.
	8.1.2 List and describe different kinds of energy.
	8.1.3 Name some energy sources and indicate the availability of each.
	8.1.4 Discuss the pros and cons of using coal, water, oil, nuclear fusion, and nuclear fission to produce electricity.
8.2 Know that energy can neither be created nor destroyed under ordinary conditions, but may be changed from one form into another.	8.2.1 List common electrical devices that convert electrical energy into heat, light, and mechanical energy.
	8.2.2 Explain how heat engines convert heat into mechanical energy.
8.3 Know about the transfer of energy.	8.3.1 Give examples of mechanical transfer of energy.
	8.3.2 Give examples of energy transfer by waves.
	8.3.3 Demonstrate and describe longitudinal and compressional waves when given a metal coil.
	8.3.4 Demonstrate and describe transverse waves when given a rope.
	8.3.5 Draw a diagram showing amplitude and wavelength of a transverse wave.
	8.3.6 Describe characteristics of the electromagnetic spectrum.

Grade Level: 8

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 8: The learner will understand basic phenomena related to physics.

Objectives	Measures
8.4 Have knowledge of the properties of light.	8.4.1 Describe the properties of light.
	8.4.2 Describe light reflection and refraction.
	8.4.3 Describe how concave and convex lenses affect light.
	8.4.4 Describe how light is used in solar energy devices--photovoltaics and active and passive solar systems.
8.5 Know about sound waves.	8.5.1 Describe how sound waves are produced.
	8.5.2 Identify characteristics of sound waves.
	8.5.3 Explain how pitch and volume are related to frequency and amplitude.
	8.5.4 Explain how sound waves travel through different materials.
8.6 Know about static electricity.	8.6.1 Explain the causes of static electricity.
	8.6.2 Demonstrate and explain the interaction of two electrically charged objects.
	8.6.3 Identify and define conductors and insulators.
8.7 Know how electric current is measured.	8.7.1 Define electric current.
	8.7.2 Define and measure voltage.
	8.7.3 Define and measure amperage.
	8.7.4 Define and measure electrical resistance.
	8.7.5 Diagram and label a simple circuit.

Skills/Subject Area: Integrated Science

COMPETENCY GOAL 8: The learner will understand basic phenomena related to physics.

Objectives		Measures	
8.8	Know about series and parallel circuits.	8.8.1	Demonstrate a parallel circuit with two lights.
		8.8.2	Demonstrate a series circuit with two lights.
8.9	Know how to measure electric power.	8.9.1	Define electric power and give its unit of measurement.
		8.9.2	Calculate the watts of power used by an appliance when given a word problem.
		8.9.3	Determine the number of kilowatt-hours consumed when given a diagram of the dial(s) on an electric meter.
		8.9.4	Calculate the cost of electrical energy when given the kilowatt-hour rates and electric meter readings.

Major Emphases

The high school science curriculum is characterized by the opportunity to study physical science, biology, earth science, chemistry, and physics from approaches representing two types of courses: academic and applied/technical. This permits students with different interests and abilities to select their own courses of study to fit their educational and vocational objectives.

The academic courses are designed for students who desire a more in-depth understanding of science concepts. These courses are more abstract and suitable for the student interested in pursuing a science-related career above the technical level. Considerable emphasis is placed on mathematics in these courses and instruction is more specialized.

The applied/technical courses are designed to provide opportunity for students to gain a general understanding of the fundamental principles of science while stressing the application of science to everyday problems and the world of work. Mathematical requirements are limited to basic mathematics in these courses. A major objective is to introduce students to the world of science and to instill in them an appreciation for the value of science as it relates to the well-being of each individual.

Both course types contain the basic science content areas (physical science, biology, earth science, chemistry, and physics) usually offered in grades 9-12. A variety of enrichment courses of an exploratory nature and/or related to the world of work may be included in the applied/technical group. Additional academic courses represent a variety of other electives including advanced (2nd year) and advanced placement courses. Only one outline per subject for both types of courses (academic, applied/technical) is provided in this publication. The main differences in the two types of courses are content depth, emphasis on mathematics, and the emphasis given to application in regard to the world of work.

Physical Science Outline

1. Introduction to Physical Science

    1.1 The nature and limitations of science
    1.2 Scientific methods
    1.3 Scientific measurement
    1.4 Technology of science
    1.5 Laboratory safety and equipment
    1.6 Recent advances in the physical sciences
    1.7 Current societal issues related to physical science
    1.8 Physical science-related careers

2. The Atom

    2.1 Properties of matter
    2.2 Atomic structure
    2.3 Radioactive isotopes

3. Inorganic Chemistry

    3.1 Periodic chart of elements
    3.2 Chemical properties
    3.3 Compounds and mixtures
    3.4 Chemical reactions
    3.5 Solutions
    3.6 Oxidation and reduction

4. Organic Chemistry

    4.1 Basic compounds of carbon
    4.2 Sources and uses of hydrocarbons

5. Mechanics

    5.1 Vector and scalar quantities
    5.2 Work, energy, and power
    5.3 Machines
    5.4 Motion
    5.5 Forces
    5.6 Mechanics of fluids

6. Electricity and Magnetism

    6.1 Electricity
    6.2 Magnetism
    6.3 Electromagnetic application
    6.4 Measuring electricity

- 6.5 Types of circuits
- 6.6 Controlling electric current
- 6.7 Electrical chemistry
- 6.8 Conversion of electrical energy
- 6.9 Solid-state electronics

7. Energy

    - 7.1 Wave phenomenon, sound, light
    - 7.2 Heat
    - 7.3 Nuclear
    - 7.4 Chemical
    - 7.5 Mechanical

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 1: The learner will understand the nature and importance of physical science to our daily lives.

Objectives		Measures
1.1 Know the nature and limitations of science.	1.1.1	State that science is both a process and a body of knowledge.
	1.1.2	State and tell about several advances in technology.
	1.1.3	Discuss advantages and disadvantages of people's dependence on science and technology.
1.2 Know the basic concepts of scientific methods.	1.2.1	Demonstrate the ability to observe.
	1.2.2	Demonstrate the ability to classify objects on the basis of observable characteristics.
	1.2.3	Record observed information from science experiences in tabular form.
	1.2.4	Make predictions based on data.
	1.2.5	Infer what the results of an investigation mean.
	1.2.6	State logical conclusions to problems.
1.3 Know how to make accurate measurements.	1.3.1	Demonstrate an understanding of measurement by using the appropriate instruments to measure mass, volume, and length.
	1.3.2	Identify four basic units of the metric system of measurement.
	1.3.3	Demonstrate an understanding of instrument sensitivity, parallax, and judgment errors.

Grade Level: 9-12 Page 2

Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 1: The learner will understand the nature and importance of physical science to our daily lives.

Objectives	Measures
1.4 Have knowledge of the technology of science.	1.4.1 State that technology is the application of science.
	1.4.2 Give examples of everyday applications of physical science.
	1.4.3 Debate whether technology is good, bad, or both, using examples such as nuclear medicine, nuclear energy, and nuclear weapons.
1.5 Have knowledge of laboratory safety procedures.	1.5.1 Demonstrate the proper use of science safety equipment.
	1.5.2 Identify safety equipment needed in a science laboratory.
1.6 Have knowledge of some of the recent advances in physical science.	1.6.1 Give a report on a recent finding or invention.
	1.6.2 Give a report on an interview with a university or industrial scientist, farmer, or businessman who is using a recent advance in the physical sciences.
1.7 Have knowledge of current societal issues related to physical science.	1.7.1 Explain the advantages and disadvantages of the uses of various forms of energy: hydro, solar, geothermal, nuclear, fossil, and biomass.
	1.7.2 Explain with examples the difference between science and technology.
	1.7.3 Discuss recent happenings reported in the news media related to physical science issues.

Grade Level: 9-12

Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 1: The learner will understand the nature and importance of physical science to our daily lives.

Objectives		Measures	
1.8	Have knowledge of physical science-related careers.	1.8.1	Develop a list of physical science-related careers.
		1.8.2	Give the job description and educational requirements for a chemist, physicist, and chemical technician.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 2: The learner will understand the atomic structure of matter.

Objectives	Measures
2.1 Know that all matter is composed of basic units called atoms which can be described by their properties.	2.1.1 Define matter as anything that has mass and occupies space.
	2.1.2 Distinguish between chemical and physical properties.
2.2 Know the general atomic theory of the structure of matter.	2.2.1 State that all matter is composed of basic units called atoms.
	2.2.2 Demonstrate knowledge of the positions of protons, neutrons, and electrons in an atom.
2.3 Have knowledge of the energy within the nucleus.	2.3.1 Define an isotope.
	2.3.2 Define radioactivity in terms of alpha, beta, and gamma radiation.
	2.3.3 Draw a model illustrating differences between isotopes of an element.
	2.3.4 Explain three ways radiation is detected (ionization, scintillation, and photography).
	2.3.5 Distinguish between fission and fusion.
	2.3.6 Debate the pros and cons of nuclear power.
	2.3.7 List situations where radioactive isotopes are used.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 3: The learner will understand inorganic chemistry.

Objectives	Measures
3.1 Know that the periodic chart of elements is based on properties that periodically occur throughout the sequence of elements.	3.1.1 Identify the major characteristics of selected elements when given a periodic chart.
	3.1.2 Describe the general arrangement of the periodic table such as by families, periods, and activity.
3.2 Know that chemical properties of an element are determined by the electron configuration of its atoms.	3.2.1 Draw atoms showing proper electron placement when given a list of common elements and a periodic chart.
	3.2.2 Indicate the valence or oxidation state of an atom when given a diagram.
3.3 Know differences between compounds and mixtures.	3.3.1 Identify compounds, mixtures, and elements from a list.
	3.3.2 List two ways compounds differ from mixtures.
	3.3.3 Write the formula of a specified compound.

Grade Level: 9-12

Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 3: The learner will understand inorganic chemistry.

Objectives	Measures
3.4 Know that chemical reactions occur when two or more elements interact and form one or more new substances.	3.4.1 Write chemical equations from word equations.
	3.4.2 Demonstrate knowledge of the law of conservation of mass by writing balanced equations.
	3.4.3 Classify chemical reactions as one of the four basic types: synthesis, decomposition, single, and double replacement.
	3.4.4 Distinguish between the chemical and physical properties of acids, bases, and salts.
	3.4.5 Express the acidity of a solution using a pH scale.
	3.4.6 Distinguish between electrolytes and nonelectrolytes.
	3.4.7 Predict that a salt will form and identify the process as neutralization when given a reaction between an acid and a base.
3.5 Know the basic characteristics of solutions.	3.5.1 Identify the various types of solutions: liquids, gases, solids.
	3.5.2 Explain how to perform a test determining a true solution from a colloid.
3.6 Know the processes of oxidation and reduction.	3.6.1 Define ionic bonding.
	3.6.2 Define chemical oxidation and reduction and illustrate the process using simple reaction equations.
	3.6.3 Give examples of how reduction is used in purifying metals.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 4: The learner will have a general understanding of organic chemistry.

Objectives	Measures
4.1 Know that organic chemistry is basically the study of carbon and its compounds.	4.1.1 List examples and draw structures of common organic compounds.
	4.1.2 Define covalent bonding.
	4.1.3 Identify the processes of hydrogenation, cracking, alkylation, and polymerization as ways of altering organic compounds.
	4.1.4 Describe how natural latex (raw rubber) can be coagulated and vulcanized.
4.2 Know that the major source of hydrocarbon compounds is the remains of prehistoric plants and animals.	4.2.1 Describe how coal, petroleum, and natural gas are believed to have formed.
	4.2.2 Describe how fibers can be made through the process of polymerization.
	4.2.3 List the basic source of raw materials for making plastics.
	4.2.4 List ways plastics are important to society.
	4.2.5 Discuss the pros and cons of the products of a chemical industry as they relate to society.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 5: The learner will have an understanding of mechanics.

Objectives	Measures
5.1 Know about vector and scalar quantities.	5.1.1 Identify vector and scalar quantities when given a list.
	5.1.2 Solve problems with interacting vectors by using the graphing method.
5.2 Have knowledge of work, energy, and power.	5.2.1 Define work.
	5.2.2 Identify work and nonwork situations.
	5.2.3 Define energy.
	5.2.4 Define and give examples of kinetic and potential energy.
	5.2.5 List different kinds of energy such as chemical, heat, electrical, and mechanical.
	5.2.6 Describe several energy sources for each kind of energy.
	5.2.7 Explain the limitations of certain energy sources and describe specific ways in which individuals can conserve energy.
	5.2.8 Define power.
	5.2.9 Calculate power when given a simple word problem.
	5.2.10 Demonstrate how the rate of work may vary in a given simple apparatus.

Grade Level: 9-12 Page 2

Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 5: The learner will have an understanding of mechanics.

Objectives		Measures
5.3 Know that machines are devices that assist in doing work.	5.3.1	Identify simple machines and describe their functions and practical applications.
	5.3.2	Calculate the mechanical advantage when given machine problems.
	5.3.3	Predict and verify forces when using machines, mechanical advantages, and resistance.
5.4 Know that motion of an object can be described by its velocity and/or acceleration.	5.4.1	Calculate the velocity of a moving object when given a simple word problem.
	5.4.2	Determine the acceleration of an object when given a simple word problem.
	5.4.3	State the three laws of motion using common examples.
5.5 Have knowledge of gravitational and other forces.	5.5.1	Give a definition and example of gravity.
	5.5.2	Give a definition and example of centripetal force.
	5.5.3	Describe the contributions that Galileo and Newton made to the understanding of gravity.
	5.5.4	Describe the changes in gravitational forces acting on two objects as the distance and/or mass between them change.
	5.5.5	Demonstrate centripetal force when given appropriate materials.

Grade Level: 9-12

Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 5: The learner will have an understanding of mechanics.

Objectives		Measures	
5.6	Have knowledge of fluids and their mechanical properties.	5.6.1	Define the term "fluid."
		5.6.2	Describe fluid pressure.
		5.6.3	Identify instruments which are used to measure pressure.
		5.6.4	Define Pascal's Law.
		5.6.5	Solve problems using Pascal's Law.
		5.6.6	Determine the density of an object.
		5.6.7	Explain Bernoulli's Principle.
		5.6.8	State practical uses of Bernoulli's Principle.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 6: The learner will have an understanding of electricity and magnetism.

Objectives	Measures
6.1 Know that static electricity results from an accumulation of excess electrons or protons on a nonconductor.	6.1.1 Identify the interaction of two charged objects with respect to attraction or repulsion.
	6.1.2 Define conductors and insulators and give examples of each.
6.2 Know that magnetism is caused by similar orientation of atoms within certain metallic elements.	6.2.1 Demonstrate and explain the pattern of magnetic lines of force when given a bar magnet and iron filings.
	6.2.2 Draw a model showing the correct orientation of atoms in a magnet.
	6.2.3 Explain why heating or striking a magnet may demagnetize it.
6.3 Know that electric motors and generators are based on discoveries by Oersted and Faraday.	6.3.1 Demonstrate, when given wire, battery, and a compass, that a wire carrying an electric current produces a magnetic field.
	6.3.2 Demonstrate, when given a bar magnet, wire, and a compass, that a current is produced in a conductor passing through a magnetic field.
6.4 Know that measuring electrical current involves the units of voltage, current, and resistance.	6.4.1 Explain that Ohm's Law is a mathematical statement of the relationship between voltage, resistance, and current.
	6.4.2 Identify the circuit with the lowest current flow when given diagrams of four circuits with only the resistance varying.
	6.4.3 Solve for any one variable using Ohm's Law when given a word problem with variables of voltage, ohms, and amperage.

Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 6: The learner will have an understanding of electricity and magnetism.

Objectives		Measures	
6.5	Know the difference between parallel and series circuits.	6.5.1	Explain that the total circuit voltage of several connected dry cells depends on whether they are joined in series or parallel.
		6.5.2	Compute voltage when cells are connected in parallel or in series.
6.6	Know that electrical currents can be controlled and altered with different devices.	6.6.1	Explain the function of a rheostat.
		6.6.2	Explain the function of a transformer.
		6.6.3	Explain the function of a rectifier.
6.7	Know that chemical reactions can produce electricity and vice versa.	6.7.1	Give a simple explanation of a voltaic cell.
		6.7.2	Demonstrate the differences between solutions of electrolytes and nonelectrolytes.
		6.7.3	Identify practical uses of chemical reactions which occur in such devices as the dry cell and car battery.
6.8	Know that electrical energy can be converted to other forms.	6.8.1	Give examples of devices that convert electrical energy to other energy forms.
		6.8.2	Explain the operation of a generator and a motor.

Grade Level: 9-12

Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 6: The learner will have an understanding of electricity and magnetism.

Objectives	Measures
6.9 Know that solid-state electronics play an important role in a technological society.	6.9.1 Describe the basic operation of a transistor.
	6.9.2 Describe the basic operation of an integrated circuit.
	6.9.3 List common devices that use solid-state electronics.
	6.9.4 List the advantages and disadvantages of using solid-state electronics.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 7: The learner will have an understanding of energy.

Objectives		Measures	
7.1	Know that energy is transmitted by means of wave motion.	7.1.1	Demonstrate the difference between transverse and longitudinal waves.
		7.1.2	Define amplitude, frequency, and wavelength.
		7.1.3	Describe how sound waves are produced and list their basic characteristics.
		7.1.4	Describe the electromagnetic spectrum.
		7.1.5	Explain that light is part of the electromagnetic spectrum.
		7.1.6	Describe the relationship of frequency and color in the light spectrum.
		7.1.7	Draw ray diagrams to demonstrate the behavior of light in relation to plane, convex, and concave lenses and mirrors.
7.2	Have knowledge of heat energy and its applications.	7.2.1	State the relationship between energy and heat.
		7.2.2	Describe the difference between heat and temperature.
		7.2.3	Define calorie and specific heat as means of measuring heat energy.
		7.2.4	Describe the three processes of heat transfer and give an everyday application of each.
		7.2.5	Define heat of vaporization and heat of fusion in relation to phase change.
		7.2.6	List examples of modern heat engines used in transportation and describe the relative efficiency of each.

Grade Level: 9-12

Skills/Subject Area: Physical Science--Academic

COMPETENCY GOAL 7: The learner will have an understanding of energy.

Objectives	Measures
7.3 Have knowledge of nuclear energy.	7.3.1 Explain the difference between chemical and nuclear energy.
	7.3.2 Calculate the amount of energy released when matter is converted to energy, using the mathematical formula $E=MC^2$.
	7.3.3 Compare and contrast nuclear fusion and nuclear fission.
	7.3.4 List useful applications of radioactive isotopes in areas such as industry, medicine, and agriculture.
	7.3.5 List several factors in protecting oneself from exposure to radiation (e.g., time, distance, intensity).
7.4 Have knowledge of chemical energy.	7.4.1 Discuss systems that depend on chemical energy.
	7.4.2 List several devices that convert chemical energy into other energy forms.
7.5 Have knowledge of mechanical energy.	7.5.1 List several devices that convert mechanical energy into other energy forms.
	7.5.2 Demonstrate how mechanical energy is transferred.

SCIENCE

Grade Level: 9-12

Skills/Subject Area: Physical Science--Applied/Technical

COMPETENCY GOAL 1: The learner will understand the nature and importance of physical science to human endeavor.

Objectives	Measures
1.1 Have knowledge of the nature and limitations of science.	1.1.1 Distinguish between pure and applied science.
	1.1.2 Give examples that show limitations of science.
1.2 Have knowledge of the scientific methods.	1.2.1 Apply scientific methods to simple and practical problems.
	1.2.2 Select a science project and carry it to completion utilizing scientific methods.
	1.2.3 Demonstrate proficiency with science process skills.
1.3 Know how to measure accurately.	1.3.1 Name the basic units of length, mass, volume, and temperature in the metric system.
	1.3.2 Demonstrate accuracy with basic measurements of length, mass, volume, and temperature while performing experiments and activities.
1.4 Be knowledgeable of the technology of science.	1.4.1 List examples of scientific discoveries that have technological applications.
	1.4.2 Discuss the differences between science and technology.
	1.4.3 Make predictions of future applications of scientific discoveries.
1.5 Have knowledge of laboratory safety procedures.	1.5.1 Demonstrate the proper use of science safety equipment.
	1.5.2 Identify safety equipment needed in a science laboratory.

Grade Level: 9-12 Page 2

Skills/Subject Area: Physical Science--Applied/Technical

COMPETENCY GOAL 1: The learner will understand the nature and importance of physical science to human endeavor.

Objectives		Measures	
1.6	Have knowledge of recent advances in physical science.	1.6.1	Prepare and present reports or projects on recent advances in physical science.
		1.6.2	Discuss current events in physical science.
1.7	Have knowledge of current societal issues related to physical science.	1.7.1	List advantages and disadvantages of the use of nuclear energy.
		1.7.2	List advantages and disadvantages of current technological applications.
		1.7.3	Discuss the impact of the computer on commerce and industry.
1.8	Have knowledge of current physical science-related careers.	1.8.1	List several physical science-related careers.
		1.8.2	List job descriptions and educational requirements of several physical science-related careers.

SCIENCE

Grade Level: 9-12

Skills/Subject Area: Physical Science--Applied/Technical

COMPETENCY GOAL 2: The learner will understand the atom.

Objectives	Measures
2.1 Know that all matter is composed of basic units called atoms which can be described by their properties.	2.1.1 Define matter as anything that has mass and occupies space.
	2.1.2 Describe the atoms in each state of matter.
2.2 Have knowledge of atomic structure.	2.2.1 Identify the basic parts of an atom.
	2.2.2 Construct models of simple atoms.
	2.2.3 Describe the properties of the proton, neutron, and electron.
2.3 Have knowledge of radioactivity.	2.3.1 Define isotope.
	2.3.2 Describe types of radiation that are given off from radioactive isotopes.
	2.3.3 List situations where radioactive isotopes are used.

Grade Level: 9-12

Skills/Subject Area: Physical Science--Applied/Technical

COMPETENCY GOAL 3: The learner will understand inorganic chemistry.

Objectives		Measures	
3.1	Know that the periodic chart is based on properties that periodically occur throughout the sequence of elements.	3.1.1	Describe the general arrangement of the periodic table including families and groups.
		3.1.2	Identify two characteristics of simple elements when given a periodic chart.
3.2	Know that the chemical properties of an element are determined by the electron configuration.	3.2.1	Draw simple atoms with proper electron configuration.
		3.2.2	List chemical properties of several elements.
3.3	Know the differences between compounds and mixtures.	3.3.1	Identify examples of common mixtures and compounds.
		3.3.2	Explain how compounds differ from mixtures.
3.4	Know that chemical reactions occur when two or more elements interact.	3.4.1	Identify examples of common chemical reactions.
		3.4.2	Identify types of chemical reactions such as decomposition, synthesis, and single and double replacement.
		3.4.3	Distinguish between common acids, bases, and salts.
		3.4.4	Write simple chemical equations.
		3.4.5	Identify simple chemical names for common consumer products.
		3.4.6	Predict the product of the interaction of an acid and base.

Skills/Subject Area: Physical Science--Applied/Technical

COMPETENCY GOAL 3: The learner will understand inorganic chemistry.

Objectives		Measures
3.5 Know how solutions differ from nonsolutions.	3.5.1	Identify simple solutions and nonsolutions when given common examples.
	3.5.2	Use the terms solute and solvent correctly.

SCIENCE

Grade Level: 9-12

Skills/Subject Area: Physical Science--Applied/Technical

COMPETENCY GOAL 4: The learner will understand the basic principles of organic chemistry.

Objectives	Measures
4.1 Know that organic chemistry is basically the study of carbon and its compounds.	4.1.1 Identify common organic compounds when given examples of organic and inorganic compounds.
	4.1.2 List organic compounds found in the home.
	4.1.3 Name and construct models for common organic compounds.
4.2 Know about the major source of hydrocarbon compounds.	4.2.1 Describe how coal, petroleum, and natural gas are believed to have been formed.
	4.2.2 Describe how fibers can be made through the process of polymerization.
	4.2.3 List ways plastics are important to our society.
	4.2.4 Give examples of how the use of plastics has increased over the past 20 years.
	4.2.5 Describe how natural latex can be coagulated and vulcanized.
	4.2.6 Discuss pros and cons of the products of a chemical industry as they relate to society.

SCIENCE

Grade Level: 9-12

Skills/Subject Area: Physical Science--Applied/Technical

COMPETENCY GOAL 5: The learner will understand the basic principles of mechanics.

Objectives		Measures
5.1 Know about vector and scalar quantities.	5.1.1	Determine magnitude and direction between two points when given a map.
	5.1.2	Identify vector and scalar quantities.
	5.1.3	Investigate force vectors in the laboratory.
5.2 Understand the nature of work and energy.	5.2.1	Identify work and nonwork situations.
	5.2.2	List examples of different types of energy.
	5.2.3	Define energy.
	5.2.4	List examples of kinetic and potential energy.
	5.2.5	Name several energy sources.
	5.2.6	Explain why energy conservation is important.
	5.2.7	Name several ways that individuals can conserve energy.
	5.2.8	Describe power as the rate at which work is performed.
	5.2.9	Demonstrate common situations that have higher power requirements than others.
	5.2.10	Describe common machines and how they assist in performing work.

Skills/Subject Area: Physical Science--Applied/Technical

COMPETENCY GOAL 5: The learner will understand the basic principles of mechanics.

Objectives	Measures
5.3 Know that machines are devices that assist in doing work.	5.3.1 Draw and label simple machines. 5.3.2 Demonstrate how simple machines do work. 5.3.3 Demonstrate how the rate of work may vary in common machines.
5.4 Know that the motion of an object can be described by its velocity and acceleration.	5.4.1 Describe motion by relating distance, time, and rate. 5.4.2 Describe the differences between velocity and acceleration. 5.4.3 Calculate the velocity of an object when given simple problems. 5.4.4 Describe common examples of Newton's three laws.
5.5 Understand the nature of forces.	5.5.1 Describe the contributions that Galileo and Newton made to understanding gravity. 5.5.2 Describe the gravitational changes that occur as the mass of two bodies changes. 5.5.3 Describe the gravitational changes that occur as the distance between two bodies varies. 5.5.4 Demonstrate centripetal force when given appropriate material.

Grade Level: 9-12

Skills/Subject Area: Physical Science--Applied/Technical

COMPETENCY GOAL 5: The learner will understand the basic principles of mechanics.

Objectives		Measures
5.6 Know about fluids and their mechanical properties.	5.6.1	Identify instruments which are used to measure pressure.
	5.6.2	Describe fluid pressure.
	5.6.3	State practical uses of Pascal's Law.
	5.6.4	Grasp that fluids have weight and exert pressure.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physical Science--Applied/Technical

COMPETENCY GOAL 6: The learner will understand electricity and magnetism. **magnetism.**

Objectives	Measures
6.1 Know about static electricity.	6.1.1 Show that static electricity involves two types of charged particles when given appropriate materials.
	6.1.2 Identify the interaction of two charged objects with respect to attraction or repulsion.
	6.1.3 Identify electrical conductors and insulators.
6.2 Know that magnetism is caused by similar orientation of atoms within certain metallic elements.	6.2.1 Demonstrates the pattern of magnetic lines of force when given a bar magnet and iron filings.
	6.2.2 Draw a model showing the correct orientation of atoms in a magnet.
	6.2.3 Draw a magnetic map of flux lines when given a magnet and a compass.
6.3 Know that electric motors and generators are based on discoveries of Oersted and Faraday.	6.3.1 Demonstrate that a wire carrying an electric current produces a magnetic field.
	6.3.2 Demonstrate, when given a bar magnet, wire, and a compass, that a current is produced in a conductor passing through a magnetic field.
	6.3.3 Identify practical applications of the Oersted and Faraday principles.

Grade Level: 9-12

Skills/Subject Area: Physical Science--Applied/Technical

COMPETENCY GOAL 6: The learner will understand electricity and magnetism.

Objectives	Measures
6.4 Know that measuring electric current involves the units of voltage, current, and resistance.	6.4.1 Identify the volt as the basic unit of electric pressure.
	6.4.2 Demonstrate how to measure voltage when given appropriate materials.
	6.4.3 Identify the ampere as the basic unit for measuring the rate of electric current flow.
	6.4.4 Demonstrate how to measure amperage when given appropriate materials.
	6.4.5 Identify the ohm as the basic unit for measuring the resistance to current flow.
	6.4.6 Demonstrate how to measure electric resistance when given appropriate materials.
6.5 Know the basic types of electric circuits.	6.5.1 Demonstrate how to connect batteries in a series circuit.
	6.5.2 Demonstrate how to connect batteries in a parallel circuit.
6.6 Know how electric current can be controlled and altered.	6.6.1 Identify the rectifier as a device for changing alternating current to direct current.
	6.6.2 Identify the transformer as a device for increasing or decreasing voltage in alternating current.
	6.6.3 Identify the fuse as a device for protecting circuits from overloading.

Skills/Subject Area: Physical Science--Applied/Technical

COMPETENCY GOAL 6: The learner will understand electricity and magnetism.

Objectives	Measures
6.7 Know that chemical reactions can produce electricity and vice versa.	6.7.1 Demonstrate the difference between solutions of electrolytes and nonelectrolytes. 6.7.2 Identify practical uses of chemical reactions. 6.7.3 List the products from the electrolysis of water. 6.7.4 Demonstrate electrolysis and electroplating.
6.8 Know about conversion of electrical energy.	6.8.1 List common electrical devices that convert electrical energy into heat and light energy. 6.8.2 Discuss the efficiency of different types of electrical conversions.
6.9 Have a general knowledge of the mechanism of solid-state electronics.	6.9.1 Describe the function of a transistor. 6.9.2 Name the microchip as the basic component of the computer.

SCIENCE

Grade Level: 9-12

Skills/Subject Area: Physical Science--Applied/Technical

COMPETENCY GOAL 7: The learner will understand energy.

Objectives	Measures
7.1 Know that energy is transmitted by means of wave motion.	7.1.1 Describe the electromagnetic spectrum as a continuum of electromagnetic waves from radio to cosmic radiation.
	7.1.2 Describe the characteristics of transverse and longitudinal waves.
	7.1.3 State how sound waves are produced and list their basic characteristics.
	7.1.4 Estimate the speed of sound in air by timing an echo return.
	7.1.5 Explain that light is a part of the electromagnetic spectrum.
	7.1.6 Describe the relationship of frequency and color in the light spectrum.
	7.1.7 Demonstrate the behavior of light in relation to concave and convex lenses and mirrors.
7.2 Know about heat energy and its applications.	7.2.1 Demonstrate and describe three processes of heat transfer.
	7.2.2 Describe the differences between heat and temperature.
	7.2.3 Demonstrate and describe the effects of heat energy on the expansion and contraction of solids, liquids, and gases.
	7.2.4 Describe the behavior of molecules near absolute zero.

Skills/Subject Area: Physical Science--Applied/Technical

COMPETENCY GOAL 7: The learner will understand energy.

Objectives		Measures	
7.3	Have a general knowledge of nuclear energy.	7.3.1	Describe the characteristics of alpha, beta, and gamma radiation.
		7.3.2	Explain the differences between chemical and nuclear energy.
		7.3.3	Distinguish between nuclear fission and fusion.
		7.3.4	List practical uses of radiation.
		7.3.5	Describe ways radiation can be detected.
7.4	Know that energy can be released from chemical reactions.	7.4.1	Describe examples of chemical energy.
		7.4.2	Describe the electron as basic to chemical energy.
		7.4.3	Describe the terms endothermic and exothermic.
7.5	Know that mechanical energy is derived from other energy sources.	7.5.1	Describe power as the rate at which work is performed.
		7.5.2	Name several common machines and describe how they assist in performing work.
		7.5.3	Make a simple machine when given appropriate materials.

Biology Outline

1. The scientific background

    1.1 Nature of science
    1.2 Methods of science
    1.3 Limitations of science
    1.4 Technology of science

2. The Nature of Life

    2.1 The science of life
    2.2 The differences between living and nonliving things (characteristics of life)
    2.3 The cell (structural basis of life)
    2.4 The chemistry of life
    2.5 Dynamic equilibrium (homeostasis)

3. The Continuity of Life

    3.1 Heredity
    3.2 Genetics
    3.3 Organic variation
    3.4 Diversity among living things

4. Organisms (Anatomy, Physiology, Taxonomy)

    4.1 Anatomy and physiology, taxonomy
    4.2 Major representatives of kingdoms of living things

5. Behavior of Living Things

    5.1 Behavior and survival
    5.2 Plant tropism
    5.3 Innate behavior
    5.4 Learned behavior
    5.5 Biological rhythms
    5.6 Environmental effects

6. Biology of Humans

    6.1 Human origin and development
    6.2 Human anatomy
    6.3 Human physiology
    6.4 Human reproduction
    6.5 Health-related biology

7. Ecology

    7.1 Populations
    7.2 Communities
    7.3 Ecosystems
    7.4 Humans and the environment

8. Dynamics of Biology to People

    8.1 Biological advances
    8.2 Current societal issues in biology
    8.3 Biology-related careers

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 1: The learner will understand the nature and relationship of science to human endeavor.

Objectives	Measures
1.1 Know about the nature of science.	1.1.1 Give examples of science that exemplify it as a body of factual information, a set of theories, and a set of procedures for finding facts and developing theories.
	1.1.2 Relate examples of scientific theories that have been disproven and scientific facts that have changed.
	1.1.3 Give the scientific evidence to support the theory of evolution.
1.2 Understand the methods of science.	1.2.1 Perform laboratory exercises that use process skills such as observing, hypothesizing, interpreting data, and formulating conclusions.
	1.2.2 Provide at least one example of each of the following: a scientific discovery based on many years of investigation, and one resulting from an unplanned occurrence.
	1.2.3 Suggest at least one appropriate, controlled experiment for solving a problem.
	1.2.4 Explain the purposes a hypothesis serves in scientific problem solving.
	1.2.5 Give examples of problems or questions that cannot be solved by science because a controlled, repeatable experiment cannot be performed (e.g., the origin of the universe).

Grade Level: 9-12

Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 1: The learner will understand the nature and relationship of science to human endeavor.

Objectives	Measures
1.3 Know the limitations of science.	1.3.1 Explain the limits of time, experience, and society on scientific problem solving when given an example of a problem facing past generations.
	1.3.2 Describe several factors that have deterred scientists from finding solutions to some major problems.
	1.3.3 Give several advantages and disadvantages of society's dependence on science and technology.
	1.3.4 Defend or refute the statement that science will solve all the environmental problems induced by people.
1.4 Know about the technology of science.	1.4.1 Give examples of technological procedures available now that did not exist 10 years earlier.
	1.4.2 Give examples of careers that have been created in the past 10 years to implement new technological procedures.
	1.4.3 Discuss the benefits and dangers associated with one or more applications of modern technology (e.g., genetic engineering or biotechnology).

Grade Level: 9-12 Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 2: The learner will understand the nature of life.

Objectives	Measures
2.1 Understand that biology is the science of life and has many different components.	2.1.1 Provide an accurate definition of biology. 2.1.2 Name and define the major divisions of biology such as botany, zoology, genetics, microbiology, and ecology.
2.2 Know the differences between living and nonliving things.	2.2.1 List and discuss the differences and similarities between living and nonliving things. 2.2.2 Defend or refute the belief that a virus is a living thing. 2.2.3 Demonstrate an understanding of the law of biogenesis.

Grade Level: 9-12

Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 2: The learner will understand the nature of life.

Objectives	Measures
2.3 Know about the cell, the basic unit of living things.	2.3.1 Identify the cell as the basic unit of which living things are composed. 2.3.2 Name and describe the structure and function of common structures found in all cells. 2.3.3 Name the structures unique to prokaryotic cells, to eukaryotic cells, to viruses, to plant cells and to animal cells and describe the function of each. 2.3.4 Explain the factors that limit the size of a living cell. 2.3.5 Discuss historical events and evidence which have contributed to knowledge of the cell. 2.3.6 Correctly diagram and identify specialized cells observed in the laboratory, explaining adaptations unique to each type (e.g., elodea, onion, cheek, red/white blood cells, bacteria). 2.3.7 Discuss with examples the principle that the form of a cell is an adaptation to its performance. 2.3.8 Describe the structure, properties, and functions of biological membranes.

Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 2: The learner will understand the nature of life.

Objectives	Measures
2.4 Understand chemical processes of life.	2.4.1 Name and describe the application of chemical/physical laws such as atomic structure, bonding, chemical reactions, and movement of molecules to living materials.
	2.4.2 Describe the structural properties and functions of the four basic types of complex molecules associated with life: carbohydrates, lipids, proteins, and nucleic acids.
	2.4.3 Perform tests to identify the presence of carbohydrates, lipids, and proteins when given unknown samples of organic material.
	2.4.4 Predict the direction in which water will travel when conducting an experiment on osmosis.
	2.4.5 Explain the special roles that water plays in living systems: solvent, transport medium, and essential component in many biochemical reactions (digestion, synthesis, photosynthesis, and respiration).
	2.4.6 Explain the significant events in such cell processes as intracellular respiration, digestion, photosynthesis, and protein synthesis.
	2.4.7 Describe the effects of various environmental variables on respiration, digestion, and/or photosynthesis.

Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 2: The learner will understand the nature of life.

Objectives	Measures
2.5 Know that living things exist in a state of dynamic equilibrium.	2.5.1 Define homeostasis as a self-regulating or steady-state condition.
	2.5.2 Give examples of homeostatic mechanisms in both plants and animals (e.g., opening and closing of stomata in leaves, osmotic regulation, blood gases).
	2.5.3 Predict the fate of cells in hypertonic, isotonic, and hypotonic solutions and explain the reasons for each result.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 3: The learner will have an understanding of the continuity of life.

Objectives	Measures
3.1 Know that living things receive characteristics from the parent organism(s).	3.1.1 Describe asexual reproduction and explain why it results in identical offspring.
	3.1.2 Defend the statement that asexual reproduction is advantageous in stable environments and disadvantageous in changing environments.
	3.1.3 List several organisms that reproduce asexually.
	3.1.4 Describe cellular events during sexual reproduction.
	3.1.5 Explain or illustrate how meiosis produces cells that vary in genetic makeup.
	3.1.6 Defend the statement that sexual reproduction is advantageous in changing environments but less advantageous in stable ones.
	3.1.7 Compare and contrast mitosis and meiosis.
	3.1.8 Compare and contrast sexual and asexual reproduction, including the advantages and disadvantages of each.
	3.1.9 Provide several examples of unicellular and multicellular organisms that undergo sexual reproduction.
	3.1.10 Explain alternation of generation and the advantages of this process.
	3.1.11 Discuss the effects of both heredity and environment on a human trait such as intelligence, susceptibility to cardiovascular disease, or longevity.

Grade Level: 9-12

Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 3: The learner will have an understanding of the continuity of life.

Objectives	Measures
3.2 Know that genes composed of DNA are responsible for inherited characteristics.	3.2.1 Describe the structure of DNA and its function as the basic hereditary material by controlling cellular activity via control of the cell's enzyme systems.
	3.2.2 Describe the method by which DNA replicates itself.
	3.2.3 Explain genetic mutation and its possible effect(s) on the cell and the total organism.
	3.2.4 Explain the probable cause and effect relationship between known mutagens and cancer, and name at least two substances people might encounter in their daily lives that are considered mutagens.
3.3 Know that organic variation is important and necessary for species survival.	3.3.1 Explain how the recombination of DNA is the basis for hereditary variation.
	3.3.2 Explain, given a population case study, how the variations within the population promote species survival.
	3.3.3 Explain and give examples of how species are able to survive environmental changes.
	3.3.4 Describe the influence of mutation, selection, migration, and genetic drift on the equilibrium of genotype frequencies in sexually reproducing large populations.
	3.3.5 Define evolution as the result of changes in gene frequencies of populations over time.
	3.3.6 Explain why the frequency of some inheritable diseases, such as diabetes, is increasing in the U.S. population.
	3.3.7 Cite applications of the recombinant DNA technology.

Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 3: The learner will have an understanding of the continuity of life.

Objectives		Measures
3.4 Know about the diversity of living things.	3.4.1	Design a dichotomous key for a group of familiar objects (e.g., cars, pencils, shoes, notebooks).
	3.4.2	Design a dichotomous key for a given sample of plant materials.
	3.4.3	Devise several classification systems based on similar characteristics when given a list of animals or plants.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 4: The learner will have an understanding of the nature of organisms.

Objectives	Measures
4.1 Have a general knowledge of anatomy and physiology of organisms.	4.1.1 Support, with examples, the principle that an organism's activity, size, and habitat determine the nature of the digestive, respiratory, excretory, and transport systems.
	4.1.2 Describe various transport systems used by multicellular organisms whose cells are too distant from the environment to obtain materials by diffusion (e.g., xylem/phloem circulatory systems).
	4.1.3 Explain the function of extracellular digestion and respiration.
	4.1.4 Give evidence that the feature all respiratory devices have in common is that they expose a moist membrane to the environment.
	4.1.5 Describe the mechanisms of control and coordination: a. within cells by DNA and concentrations of materials; b. between cells by hormones and nervous systems; c. between organisms by hormones, pheromones, and other chemicals.
	4.1.6 Give examples of feedback control mechanisms.
	4.1.7 Discuss the similarities and differences of neural and hormonal coordinating systems.
	4.1.8 Describe examples of systems in multicellular organisms that provide support and movement.
	4.1.9 Describe ways in which different kinds of multicellular plants and animals reproduce and undergo development.

Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 4: The learner will have an understanding of the nature of organisms.

Objectives		Measures
4.2 Have a general knowledge of major representatives of kingdoms of living things.	4.2.1	Use a given classification system to find the organism's species name when given sufficient features of an organism.
	4.2.2	Describe the binomial system of nomenclature.
	4.2.3	Match major characteristics of various microorganisms, higher plants, vertebrates, and invertebrates with the appropriate phyla.
	4.2.4	State advantages of a biological classification system.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 5: The learner will have an understanding of the behavior of living things.

Objectives		Measures	
5.1	Know that for all organisms, survival requires suitable responses to the external environment.	5.1.1	List several examples of components of behavior such as irritability, habituation, avoidance, and learning.
		5.1.2	Conduct an experiment to investigate the effect(s) of selected environmental variables on the behavior of a selected organism (e.g., the effect of light on protozoa or pill bugs).
		5.1.3	Justify the role of behavioral adaptation in natural selection.
5.2	Have a general understanding of plant tropism.	5.2.1	Provide examples of behavioral responses by plants to changes in their environment and explain the chemical basis for each.
		5.2.2	Explain that a tropism in a plant is analogous to a taxis in an animal, being an orientation in an organism in respect to a stimulus.
5.3	Have a general knowledge of innate behavior.	5.3.1	Explain that the taxes, reflexes, and instinct are innate behaviors since they are genetically based.
		5.3.2	Trace the evolution of animal behavior in invertebrates.
		5.3.3	Explain why all individuals of a species exhibit certain common behaviors, yet may also display some variation in their behavioral patterns.

Grade Level: 9-12 Page 2

Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 5: The learner will have an understanding of the behavior of living things.

Objectives	Measures
5.4 Know the characteristics of learned behavior.	5.4.1 Cite examples of imprinting, habituation, and associative learning.
	5.4.2 Discuss ideas and theories relative to how memory occurs.
	5.4.3 Compare and contrast instinctive and learned behavior giving the benefits and limitations of each.
5.5 Know about biological rhythms.	5.5.1 Discuss the importance of internal clocks in organisms including humans.
	5.5.2 Give the effects and explain the cause of "jet lag."
5.6 Have a general knowledge of environmental effects and behavior.	5.6.1 Give examples of ways in which the physical environment affects behavior such as seasonal migration and effects of light on reproduction in birds.
	5.6.2 Give examples of ways in which the biotic environment affects behavior.

Grade Level: 9-12 Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 6: The learner will have an understanding of the biology of humans.

Objectives	Measures
6.1 Understand the nature of human origin and development.	6.1.1 Compare and contrast theories related to the origin and development of humans.
	6.1.2 Give evidence to support the theory of evolution.
	6.1.3 Trace the societal development of humans using fossil records for evidence.
6.2 Have a general knowledge of human anatomy.	6.2.1 Label and describe the gross structure of each major system of the human body.
	6.2.2 Label and describe the internal structure of selected tissues and organs.
6.3 Have a general knowledge of human physiology.	6.3.1 List the major functions of each organ composing the major body systems.
	6.3.2 Explain how the human body is regulated by neural and hormonal interaction.
6.4 Have a general knowledge of human reproduction.	6.4.1 Explain the process of human reproduction, including neural and hormonal control of the reproductive process.
	6.4.2 Cite an example of feedback control and explain the importance of this regulatory mechanism.
	6.4.3 Discuss the various methods and means of preventing conception.
	6.4.4 Explain the process of in vitro fertilization.

Grade Level: 9-12

Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 6: The learner will have an understanding of the biology of humans.

Objectives	Measures
6.5 Have a general knowledge of major genetic and environmental factors that affect health.	6.5.1 List several known or suspected carcinogens, including the common source of contact and the organs generally affected by each.
	6.5.2 Explain the cause, prevention, and (if possible) cure for some major diseases caused by inherited traits, nutritional deficiencies, and pathogenic organisms.
	6.5.3 Discuss the influence of antibiotics on human health.
	6.5.4 Explain the increased incidence of diabetes in the human population.
	6.5.5 Discuss the relative importance of heredity and environment on a given disease such as heart disease or diabetes.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 7: The learner will have an understanding of ecology.

Objectives	Measures
7.1 Understand the nature of populations.	7.1.1 Define the term population and discuss several factors that may affect the dynamics of population growth.
	7.1.2 Cite some ways in which large and small populations are alike and different.
	7.1.3 Define species in terms of populations.
	7.1.4 Prepare a map showing the location(s) of endangered plant and animal species in North Carolina.
7.2 Understand the nature of communities.	7.2.1 Define community and explain the interactions of populations of a given biotic community.
	7.2.2 Discuss the concept of succession.
7.3 Understand the nature of ecosystems.	7.3.1 Identify the biotic and abiotic parts of a given ecosystem.
	7.3.2 Trace the energy flow and identify trophic levels within a given ecosystem.
	7.3.3 Identify symbiotic interactions and predator/prey relationships within a given ecosystem.
	7.3.4 Discuss the water, carbon, and nitrogen cycles within a balanced ecosystem.
	7.3.5 List and describe characteristics of major biomes.
	7.3.6 Explain why North Carolina has such a multitude of different ecosystems.

Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 7: The learner will have an understanding of ecology.

Objectives	Measures
7.4 Have a general knowledge of the influences of human activity on the environment.	7.4.1 Identify and describe positive and negative effects people have had, and are currently having, on the environment. 7.4.2 Discuss environmental issues related to human influences such as the use of pesticides and herbicides in agriculture, endangered species, and acid rain.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Biology--Academic

COMPETENCY GOAL 8: The learner will have an understanding of how the dynamics of biology are relevant to people.

Objectives	Measures
8.1 Know about advances and discoveries in biology.	8.1.1 Cite several major advances in the history of biology such as the development of penicillin.
	8.1.2 Cite several advances in biological science areas that have been reported in the media within the past year.
8.2 Know that many current societal issues are related to biology.	8.2.1 Summarize personal, societal, and environmental consequences of recent advances or human practices related to biological sciences such as genetic engineering, polluting industries, drug abuse, medical practices, and destruction of wildlife habitats for human use.
	8.2.2 Debate the benefits and hazards associated with selected biological/societal issues.
	8.2.3 Defend or refute the value of current technology such as biotechnology and the use of pesticides.
8.3 Know that many careers are available in the biological sciences.	8.3.1 Name several careers related to the biological sciences.
	8.3.2 Outline the training requirements and describe the job outlook for a biological science-related career.
	8.3.3 Discuss/predict future trends in biological science-related careers.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Biology--Applied/Technical

COMPETENCY GOAL 1: The learner will understand the nature and relationship of science to human endeavor.

Objectives	Measures
1.1 Know about the nature of science.	1.1.1 Explain the meaning of the statement: "Science is both a body of knowledge and a process."
	1.1.2 Give examples of scientific theories that have been disproven and scientific facts that have changed.
	1.1.3 Name the scientific evidence to support the theory of evolution.
1.2 Understand the methods of science.	1.2.1 State the procedures involved in conducting an experiment.
	1.2.2 Design a simple investigation that contains the essentials of scientific methods.
1.3 Know the limitations of science.	1.3.1 Discuss the limitations of sciences (e.g., cannot make value judgments, cannot give answers to that which cannot be measured, and should not be subjective).
	1.3.2 State several areas in which medicine has advanced and identify some other areas in which there has been no advance and give reasons for both.
	1.3.3 Discuss some ways in which dependence on science and technology is an advantage and some ways in which it is a disadvantage.

Skills/Subject Area: Biology--Applied/Technical

COMPETENCY GOAL 1: The learner will understand the nature and relationship of science to human endeavor.

Objectives	Measures
1.4 Know about the technology of science.	1.4.1 Give examples of the everyday application of science, especially biology, to living things.
	1.4.2 Explain that technology is the application of science.
	1.4.3 Discuss whether technology is good, bad, or both by giving examples such as nuclear medicine, nuclear energy, and nuclear weapons.
	1.4.4 Name one or more contributions of the space program to our everyday life.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Biology--Applied/Technical

COMPETENCY GOAL 2: The learner will have an understanding of the nature of life.

Objectives		Measures	
2.1	Understand that biology is the science of life and has many different components.	2.1.1	Match job titles in the biological sciences with job descriptions.
		2.1.2	Define biology as the science of life.
2.2	Know the differences between living and nonliving things.	2.2.1	List characteristics of living things.
		2.2.2	Discuss the difficulties in distinguishing living from nonliving things.
2.3	Know about the cell, the basic unit of living things.	2.3.1	Identify the basic unit (the cell) of which living things are composed.
		2.3.2	List major structures found in all cells.
		2.3.3	Explain that cells vary in size, structure, and function.
		2.3.4	Diagram cells observed in the laboratory (e.g., cheek, onion, elodea).
		2.3.5	List major structural differences in plant and animal cells.
		2.3.6	Explain that cancer is rapid cell division and growth of nonspecialized cells.
2.4	Understand chemical processes of life.	2.4.1	Name some basic chemical elements found in all living things.
		2.4.2	Name the basic classes of compounds found in all organisms and name their "building blocks."
		2.4.3	Explain in general terms the processes of photosynthesis and respiration.
		2.4.4	Explain why photosynthesis and respiration are important to both plants and animals.

Skills/Subject Area: Biology--Applied/Technical

COMPETENCY GOAL 2: The learner will have an understanding of the nature of life.

Objectives	Measures
2.5 Know that living things exist in a state of dynamic equilibrium.	2.5.1 Define, in simple terms, what is meant by homeostasis. 2.5.2 Explain that individual cells must exist in a balanced condition with materials moving in and out of each cell. 2.5.3 Explain how a fever is related to homeostasis. 2.5.4 Predict what will happen when a potato slice is placed in very salty water.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Biology--Applied/Technical

COMPETENCY GOAL 3: The learner will have an understanding of the continuity of life.

Objectives	Measures
3.1 Understand that living things receive characteristics from parent organisms.	3.1.1 Explain the relationship of genetics to heredity.
	3.1.2 Cite some obvious inherited human traits (e.g., tongue rolling, attached ear lobes).
	3.1.3 Tell why a child may have more characteristics of one parent than the other based on dominant and recessive genes.
	3.1.4 Support the contention that living things receive their characteristics from their parents.
	3.1.5 Compare and contrast asexual and sexual reproduction.
	3.1.6 Illustrate the differences in meiosis and mitosis with simple diagrams.
	3.1.7 Discuss the effects of both heredity and environment on human traits such as intelligence and longevity.
3.2 Know the genes composed of DNA are responsible for inherited characteristics.	3.2.1 State that chromosomes contain DNA.
	3.2.2 State that each parent contributes half of the chromosomes in sexual reproduction.
	3.2.3 Name several substances that people may encounter that are known or suspected mutagens.

Grade Level: 9-12

Skills/Subject Area: Biology--Applied/Technical

COMPETENCY GOAL 3: The learner will have an understanding of the continuity of life.

Objectives	Measures
3.3 Know that organic variation is important and necessary for species survival.	3.3.1 Explain the importance of variations within a population.
	3.3.2 Define mutation and list some forces that bring about such changes.
	3.3.3 Discuss the commercial importance of hybrids in crops and animals.
	3.3.4 Discuss why the frequency of some inheritable diseases such as diabetes is increasing in the population of the United States.
3.4 Know about the diversity of living things.	3.4.1 Devise a classification system when given a diverse collection of objects (e.g., buttons, leaves, animal pictures).
	3.4.2 Design a dichotomous key for a given sample of leaves.
	3.4.3 Explain why a widely accepted taxonomy is important.

Grade Level: 9-12

Skills/Subject Area: Biology--Applied/Technical

COMPETENCY GOAL 4: The learner will have an understanding of the nature of organisms.

Objectives	Measures
4.1 Have a general knowledge of the anatomy and physiology of organisms.	4.1.1 List the various functions that all living things must perform (i.e., ingestion, digestion, respiration, reproduction, excretion).
	4.1.2 Explain how the major life functions are carried out by one-cell organisms.
	4.1.3 Trace the development of the major life functions through the plant and animal kingdoms.

Grade Level: 9-12

Skills/Subject Area: Biology--Applied/Technical

COMPETENCY GOAL 4: The learner will have an understanding of the nature of organisms.

Objectives	Measures
4.2 Have a general knowledge of major representatives of kingdoms of living things.	4.2.1 Identify from a list of familiar diseases those caused by bacteria and those caused by viruses.
	4.2.2 Discuss the importance of bacterial control in food preparation and especially in home canning.
	4.2.3 Summarize the biological processes involved in sewage treatment using a flow diagram.
	4.2.4 Construct a food chain to show the importance of algae and protozoans.
	4.2.5 Explain how lichens illustrate mutualism and identify them as primary soil builders.
	4.2.6 Give examples of how fungi are helpful and harmful.
	4.2.7 Explain some important roles of mosses and ferns both now and in the past.
	4.2.8 State the characteristics of seed plants.
	4.2.9 Describe the differences among annuals, biennials, and perennials.
	4.2.10 Name the major groups of invertebrates and identify their environments.
	4.2.11 Identify those invertebrates that are economically important to the seafood industry.
	4.2.12 Name the major kinds of vertebrates and tell about the kinds of environments with which each kind is associated.
	4.2.13 Match major kinds of vertebrates with their characteristics.
	4.2.14 Compare the economic importance of vertebrates with that of invertebrates; include beneficial or harmful effects.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Biology--Applied/Technical

COMPETENCY GOAL 5: The learner will have an understanding of the behavior of living things.

Objectives	Measures
5.1 Know that for all organisms, survival requires suitable responses to the external environment.	5.1.1 List several examples of components of behavior such as irritability, habituation, avoidance, and learning.
	5.1.2 Interpret the results of an experiment to investigate the effect(s) of an environmental variable on the behavior of an organism (e.g., the effect of temperature or moisture on pill bugs).
5.2 Have a general knowledge of plant tropism.	5.2.1 Cite examples of tropisms such as gravity, light, touch, and water.
	5.2.2 Demonstrate some tropic responses using young plants.
	5.2.3 Discuss reasons why each type of tropism is important to a plant.
5.3 Have a general knowledge of innate behavior.	5.3.1 Explain that reflexes and instincts are innate behaviors since they are genetically inherited.
	5.3.2 Give examples of reflexes and instinct behavior.
5.4 Know the characteristics of learned behavior.	5.4.1 Explain that learned behavior develops on the basis of experiences.
	5.4.2 Define and give examples of learned behavior.
	5.4.3 Discuss ideas and theories relative to how memory occurs.

Grade Level: 9-12

Skills/Subject Area: Biology--Applied/Technical

COMPETENCY GOAL 5: The learner will have an understanding of the behavior of living things.

Objectives	Measures
5.5 Know about biological rhythms.	5.5.1 Discuss the importance of internal clocks in organisms including humans.
	5.5.2 Give several examples of biological rhythms.
	5.5.3 Name several environmental cues that govern biological rhythms.
5.6 Have a general knowledge of environmental effects on behavior.	5.6.1 Discuss animal migration as an example of a seasonal environmental factor.
	5.6.2 Summarize animal responses to seasonal changes other than migration.

Grade Level: 9-12 Skills/Subject Area: Biology--Applied/Technical

COMPETENCY GOAL 6: The learner will have an understanding of the biology of humans.

Objectives		Measures
6.1 Know the nature of human origin and development.	6.1.1	Discuss some of the theories related to origin and development of humans.
	6.1.2	Give evidence to support the theory of evolution.
	6.1.3	Explain the limitations of science in proving the exact origin of humans.
6.2 Have a general knowledge of human anatomy.	6.2.1	Match pictures of body systems with the appropriate names and functions.
	6.2.2	Name and describe major organs of major human body systems.
	6.2.3	Describe how skin color is produced in humans and how skin color relates to the environment.
6.3 Have a general knowledge of human physiology.	6.3.1	Describe the functions of the major body organs and the systems to which they belong.
	6.3.2	Discuss the effects of diseases (nutritional, pathogenic, genetic) upon the physiology of the human body.
6.4 Have a general knowledge of human reproduction.	6.4.1	Describe the anatomy and physiology of humans as related to reproduction.
	6.4.2	Identify and discuss various opinions and ideas related to sexuality issues (e.g., dating, sexual roles).

Grade Level: 9-12

Skills/Subject Area: Biology--Applied/Technical

COMPETENCY GOAL The learner will have an understanding of the biology of humans.

Objectives	Measures
6.5 Have a knowledge of major genetic and environmental factors that affect health.	6.5.1 Match a list of major nutrients with a list of the function of those nutrients as they relate to human health.
	6.5.2 Explain why good nutrition is especially important during adolescence.
	6.5.3 Cite examples of problems and diseases which arise from poor hygiene.
	6.5.4 Explain the cause, prevention, and treatment of selected diseases produced by inherited traits, nutritional deficiencies, and pathogenic organisms.

Grade Level: 9-12 **Skills/Subject Area:** Biology--Applied/Technical

COMPETENCY GOAL 7: The learner will have an understanding of ecology.

Objectives	Measures
7.1 Know about the nature of populations.	7.1.1 Compare the characteristics of various populations including numbers of births, deaths, and individuals.
	7.1.2 Describe the growth of a natural population and list factors that affect the status of that population.
	7.1.3 Make predictions about the behavior of a population based on factual information.
	7.1.4 Apply principles learned about animals to human populations and make predictions about population problems of humans.
	7.1.5 Identify the various populations in a picture of an ecosystem.
	7.1.6 Prepare a map showing the location(s) of endangered plants and animals in North Carolina.
7.2 Know about the nature of communities.	7.2.1 Describe different kinds of communities.
	7.2.2 Identify examples of producers, consumers, and decomposers.
	7.2.3 Identify several food chains in nature.
	7.2.4 Describe the interactions of members of the biotic community when given a sample ecosystem.

Skills/Subject Area: Biology--Applied/Technical

COMPETENCY GOAL 7: The learner will have an understanding of ecology.

Objectives	Measures
7.3 Know about the nature of ecosystems.	7.3.1 List biotic and abiotic factors when given a picture of an ecosystem. 7.3.2 Select the producers, first-order consumers, second-order consumers, and decomposers when given a food web. 7.3.3 Select specific key food chains when given a food web. 7.3.4 Identify water, carbon, and nitrogen cycles in a balanced ecosystem. 7.3.5 List and describe characteristics of major biomes.
7.4 Have a general knowledge of the influences of human activity on the environment.	7.4.1 Discuss humans and their relationships to the environment from both a positive and negative viewpoint. 7.4.2 Discuss environmental issues related to human influences such as the use of pesticides and herbicides in agriculture, endangered species, and acid rain.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Biology--Applied/Technical

COMPETENCY GOAL 8: The learner will have an understanding of how the dynamics of biology are relevant to people.

Objectives	Measures
8.1 Know about advances and discoveries in biology.	8.1.1 Cite several major advances in the history of biology such as the development of penicillin.
	8.1.2 Select examples from newspapers, magazines, and TV of recent discoveries and advances in biology.
	8.1.3 Discuss the possible effects of recent developments in biology on society.
	8.1.4 Name one or more biological experiments that are part of the space program.
8.2 Know that many current societal issues are related to biology.	8.2.1 Debate moral and ethical issues such as world hunger, population control, alternate energy sources, pollution control, world resources allocation, endangered species, and genetic engineering.
	8.2.2 List several factors involved in a bioethical issue.
8.3 Know that many careers are available in the biological sciences.	8.3.1 List career opportunities available in biology that require various levels of education.
	8.3.2 Describe the wide range of possible work environments for biology careers.

Earth Science Outline

1. Introduction to Earth Science

    1.1 Earth science as a varied group of sciences
    1.2 The earth as a body in space
    1.3 Location and mapping
    1.4 Careers in earth science
    1.5 Recent advances and societal issues

2. Minerals

    2.1 Formation
    2.2 Composition

3. Tectonics

    3.1 Composition of the earth
    3.2 Plate tectonics and diastrophism
    3.3 Volcanism

4. Geophysical Processes

    4.1 Igneous
    4.2 Sedimentary
    4.3 Metamorphic
    4.4 Land formation
    4.5 Weathering
    4.6 Soil formation

5. Historical Geology

    5.1 Uniformitarianism
    5.2 Geologic time scale

6. Meteorology

    6.1 Structure of the atmosphere
    6.2 Energy--radiation
    6.3 Heat transfer processes
    6.4 Circulation
    6.5 Clouds and precipitation
    6.6 Cyclones and anticyclones
    6.7 Severe weather conditions
    6.8 Forecasting

7. Climatology

    7.1 Nature and physical factors of climate
    7.2 Climate types
    7.3 Pollution (air) climatic effects

8. Oceanography

    8.1 Scientific study of the ocean
    8.2 Extent of earth's surface water
    8.3 Circulation of ocean water
    8.4 Water (hydrologic) cycle
    8.5 Submarine topography
    8.6 Resources from sea water
    8.7 Vertical structure
    8.8 Composition and characteristics of sea water
    8.9 Waves
    8.10 Shoreline modification/erosion
    8.11 Tides

9. Astronomy

    9.1 Tools of astronomy
    9.2 Theories of origin
    9.3 The solar system
    9.4 The earth/moon system
    9.5 Beyond the solar system

10. Space Exploration

    10.1 History
    10.2 Rockets
    10.3 Escape and orbital problems and principles
    10.4 Satellites and space probes
    10.5 Present and future

11. Resources and Environment

    11.1 Earth's resources
    11.2 Environment

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 1: The learner will have a general understanding of earth science.

Objectives	Measures
1.1 Know that earth science is a varied group of sciences employing many techniques to investigate the earth.	1.1.1 Explain the nature of studies in astronomy, geology, meteorology, climatology, and oceanography.
	1.1.2 Explain how the various branches of the earth sciences relate to one another when given their descriptions.
1.2 Know that the earth is a body moving through space.	1.2.1 Provide evidence that the earth is essentially a sphere using such techniques as satellite photographs and the earth's shadow on the moon.
	1.2.2 Show that the earth is in motion in space using examples such as the apparent motions of the stars, moon, or planets.
	1.2.3 Demonstrate the earth's rotation on its axis, using a model, and explain how day and night result from that motion.
	1.2.4 Demonstrate how seasons result from the earth's motion around the sun.
	1.2.5 Explain why the earth bulges at the equator and is flattened at the poles.
1.3 Know that the earth's motions allow the precise location of places on the earth's surface and the determination of time.	1.3.1 Demonstrate how the earth's rotation is used to determine time using lines of longitude.
	1.3.2 Demonstrate how latitude and longitude are used to locate a point on the earth's surface.
	1.3.3 Show how maps are used to model the earth.

Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 1: The learner will have a general understanding of earth science.

Objectives		Measures	
1.4	Be aware of career opportunities in earth science.	1.4.1	List several career opportunities in earth science (e.g., geology, astronomy, oceanography, meteorology).
		1.4.2	Contact organizations and companies for personal interviews or information about career opportunities.
1.5	Know of recent advances in earth science and how these current issues affect society.	1.5.1	Discuss several recent advances in the earth sciences.
		1.5.2	Cite and discuss current societal issues related to earth science.

Grade Level: 9-12 Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 2: The learner will have a general understanding of the earth's composition and its behavior.

Objectives	Measures
2.1 Have knowledge about the formation of minerals.	2.1.1 Explain how minerals form as magma cools. 2.1.2 Demonstrate how minerals are formed by evaporation and precipitation.
2.2 Know that rocks are composed of two or more minerals.	2.2.1 Identify several rock types and the minerals found in them. 2.2.2 Explain how properties of minerals are determined by the arrangement of their atoms. 2.2.3 Describe basic properties of minerals. 2.2.4 Identify rock-forming minerals using hardness, luster, color, and streak.

SCIENCE

Grade Level: 9-12 **Skills/Subject Area:** Earth Science--Academic

COMPETENCY GOAL 3: The learner will have a general understanding of tectonics.

Objectives		Measures
3.1 Know about the composition of the earth.	3.1.1	Describe properties and characteristics of the lithosphere.
	3.1.2	Describe the properties and characteristics of the earth's mantle.
	3.1.3	Describe the properties and characteristics of the earth's core.
	3.1.4	Construct a model of the earth showing the relation and scale of the core, mantle, and lithosphere.
3.2 Know the processes of plate tectonics and diastrophism.	3.2.1	Explain the theory of plate tectonics.
	3.2.2	Explain the evidence for tectonics.
	3.2.3	Describe several ways in which rocks respond to deformational forces.
	3.2.4	Show the relationship between faults and earthquakes.
	3.2.5	Describe anticlines and synclines.
	3.2.6	Describe the characteristics of landforms created by tectonic activity.
3.3 Know how tectonic action causes volcanoes.	3.3.1	Explain how chains of volcanoes are formed by subducting crustal plates.
	3.3.2	Explain hot spot volcanoes.
	3.3.3	Describe types of volcanic eruptions.
	3.3.4	Recognize several types of extrusive and intrusive igneous rock structures.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 4: The learner will have a general understanding of geophysical processes.

Objectives	Measures
4.1 Know about igneous processes.	4.1.1 Recognize several types of igneous rock.
	4.1.2 Describe the processes which form igneous rock.
	4.1.3 Describe the principal landforms resulting from igneous processes.
4.2 Know the processes of the sedimentary rock cycle.	4.2.1 Describe how sedimentary rocks are formed.
	4.2.2 Give examples of depositional landforms.
	4.2.3 Recognize several types of sedimentary rocks.
	4.2.4 Explain several processes by which fossils are preserved.
4.3 Know about metamorphic rock formation.	4.3.1 Recognize several types of metamorphic rocks.
	4.3.2 Explain the changes that take place during metamorphism.
	4.3.3 Explain how the process of metamorphism fits into the rock cycle.
4.4 Know variations and characteristics of landforms.	4.4.1 Describe several landforms and their causes.
	4.4.2 Identify several landform types from maps.
	4.4.3 Explain the difference between youthful, mature, and old age landforms.
	4.4.4 Describe some ways in which people's activities are affected by landforms.

Grade Level: 9-12

Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 4: The learner will have a general understanding of geophysical processes.

Objectives	Measures
4.5 Know about weathering.	4.5.1 Explain the difference between physical and chemical weathering.
	4.5.2 Explain that weathering takes place at the interface between rocks and the environment.
	4.5.3 Explain several processes that cause weathering.
	4.5.4 Give several examples of gravity moving material downhill.
	4.5.5 Describe several features and processes related to wind erosion.
	4.5.6 Describe several features and processes related to glacial erosion.
	4.5.7 Explain how deposits of material reflect the conditions under which they were deposited.
4.6 Know about soil formation.	4.6.1 Describe the general composition of soil and explain why soil is known as a biogeochemical reaction product.
	4.6.2 Demonstrate and explain a soil profile.
	4.6.3 Describe chemical and physical properties of soil.
	4.6.4 Describe several ways that people's activities accelerate soil erosion.
	4.6.5 Name some types of soils found in the United States.
	4.6.6 List ways that people can prevent or slow soil erosion.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 5: The learner will have a general understanding of historical geology.

Objectives		Measures	
5.1	Know that our present understanding of geologic history is based, in part, on the theory of uniformitarianism.	5.1.1	Explain that geologic time is measured by means of events.
		5.1.2	Explain the basic rules on which the relative ordering of geologic events is based.
		5.1.3	Describe general evidence for the orderly development of life forms in the geologic record.
		5.1.4	Explain, in simple terms, how radioactive decay can be used to determine the age of rocks.
5.2	Have knowledge of the geologic time scale.	5.2.1	Identify the major events which make up the geologic history of the Eastern United States using a geologic time chart.
		5.2.2	Develop a model of a geologic time scale.
		5.2.3	Cite evidence that humans are recent occupants of the earth.

SCIENCE

Grade Level: 9-12 **Skills/Subject Area:** Earth Science--Academic

COMPETENCY GOAL 6: The learner will have a basic understanding of meteorology.

Objectives	Measures
6.1 Know the structure of the atmosphere.	6.1.1 Compare the thickness of the atmosphere with the diameter of the earth.
	6.1.2 List the relative abundance of the major gases that make up the atmosphere.
	6.1.3 Draw a vertical profile of the atmosphere.
	6.1.4 Explain the importance of the ozonosphere.
6.2 Know that energy from the sun is responsible for most of the processes on earth.	6.2.1 Describe the balance of incoming and outgoing radiation.
	6.2.2 Use a diagram to explain how air temperature is related to radiant energy and cloud cover.
6.3 Know about heat transfer processes.	6.3.1 Explain the characteristics of radiation, conduction, and convection.
	6.3.2 Describe examples from actual conditions in which each of the heat transfer processes are involved.

Grade Level: 9-12

Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 6: The learner will have a basic understanding of meteorology.

Objectives	Measures
6.4 Know causes and patterns of general atmospheric circulation.	6.4.1 Describe the driving mechanism for the general circulation pattern of our atmosphere.
	6.4.2 Draw the circulation patterns of the atmosphere.
	6.4.3 Demonstrate that air movement is caused by heating and cooling.
	6.4.4 Explain how unequal distribution of solar energy produces general circulation in the atmosphere.
	6.4.5 Show how the earth's rotation modifies the basic atmospheric circulation by the production of wind belts.
	6.4.6 Show how wind belts move air masses from one place to another and explain how those air masses affect local weather conditions using a standard weather map.
	6.4.7 Explain the phenomena of local breezes such as sea breezes and land breezes.
6.5 Know the physical processes that cause clouds and precipitation.	6.5.1 Describe how clouds are formed.
	6.5.2 Explain how clouds and precipitation droplets form by the condensation of water vapor on and around various types of particles.
	6.5.3 Use a chart to show that different types of precipitation form under different temperature conditions.

Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 6: The learner will have a basic understanding of meteorology.

Objectives		Measures	
6.6	Know characteristics of cyclones and anticyclones.	6.6.1	Describe the wind flow and atmospheric pressure conditions in cyclones and anticyclones.
		6.6.2	Associate general weather conditions with cyclones and anticyclones.
		6.6.3	Demonstrate how a storm system (cyclone) forms when two dissimilar air masses (anticyclones) meet, using a map.
		6.6.4	Trace the life cycle of a typical cyclone across the United States using standard weather maps and symbols.
6.7	Know the various forms of severe weather conditions.	6.7.1	Describe the origin, life cycle, and behavior of thunderstorms, tornadoes, and hurricanes.
		6.7.2	Describe the safety precautions to be taken with violent storms including lightning.

Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 6: The learner will have a basic understanding of meteorology.

Objectives	Measures
6.8 Know general characteristics of simple weather patterns and short-range forecasting.	6.8.1 Explain how weather follows natural laws and can be predicted.
	6.8.2 Demonstrate how common atmospheric properties are measured using simple instruments such as a thermometer, hydrometer, anemometer, and rain gauge.
	6.8.3 Identify the general patterns of weather systems in the Northern Hemisphere.
	6.8.4 Demonstrate how weather information is used to predict weather.
	6.8.5 Identify common weather/air mass features that are associated with weather types such as cold fronts, thunderstorms, and strong winds.
	6.8.6 Describe the features of a typical National Weather Service forecast and interpret its content.
	6.8.7 Explain how satellites are used with computers and radar to develop forecasts.
	6.8.8 Describe severe weather forecasts, watches, and warnings.
	6.8.9 Demonstrate a knowledge of the National Weather Radio System, including its use.
	6.8.10 Create short-range forecasts based upon prepared weather maps.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 7: The learner will have a basic understanding of climate.

Objectives	Measures
7.1 Know the nature and physical factors of climate.	7.1.1 Explain the difference between weather and climate.
	7.1.2 Give examples of climate that are altered by geography.
	7.1.3 Demonstrate how seasons are caused.
	7.1.4 Explain what the National Climate Center does and describe some of its products.
7.2 Know that different climates exist in various places on the earth.	7.2.1 Name at least three major climatic regions of the world and their major causes.
	7.2.2 Give examples of how the climate may affect the plant and animal life in a particular climatic region.
7.3 Know how air pollution may affect the earth's climate.	7.3.1 State at least three pollutants in our atmosphere that are being studied now such as acid rai[illegible]oke, and dust.
	7.3.2 Discuss [illegible]lution affects climate.
	7.3.3 List possible effects of suspended material on average global temperature.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 8: The learner will have a basic understanding of the physical, chemical, and biological characteristics of the world's oceans.

Objectives	Measures
8.1 Know about the study of oceanography.	8.1.1 Describe how maps of the ocean bottom are made.
	8.1.2 Explain the difference between a bathysphere and a bathyscaphe.
	8.1.3 Describe some of the methods used to explore the oceans such as the Nansen bottle and the bathythermograph.
8.2 Know of the vastness of the earth's surface waters.	8.2.1 Describe by percentage the amount of earth's surface that is covered by water.
	8.2.2 Identify several methods to determine the amount of water contained in the ocean.
8.3 Know how ocean waters circulate.	8.3.1 Identify the primary cause of major ocean surface currents such as the Gulf Stream and Kuroshio.
	8.3.2 List characteristics of several ocean currents.
	8.3.3 List several major ocean surface currents and identify them as warm or cold.
	8.3.4 Show on a globe that deep water circulation is caused by the sinking of cold water near the poles.
	8.3.5 Demonstrate the principle of upwelling.

Grade Level: 9-12

Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 8: The learner will have a basic understanding of the physical, chemical, and biological characteristics of the world's oceans.

Objectives		Measures	
8.4	Know how water is recycled through the natural process called the hydrologic cycle.	8.4.1	Demonstrate how water runs over and through the earth by using sand and clay on a stream table.
		8.4.2	Show how plant transpiration is an important source of water vapor to the atmosphere.
		8.4.3	Demonstrate the process of distillation and explain its relationship to the hydrologic cycle.
		8.4.4	Prepare a chart showing the various aspects of the hydrologic cycle.
8.5	Know that the undersea landscape has topographic features.	8.5.1	Identify and name submarine topographic features such as the continental shelf and guyots on a relief map.
		8.5.2	Make comparisons between submarine and terrestrial topographic features.
8.6	Know that many important resources are found in the ocean.	8.6.1	Identify several resources found in ocean water that are economically important to people.
		8.6.2	Identify several valuable minerals and elements that can be found on the sea floor.
		8.6.3	Name and describe the zone which contains the greatest variety of living things.
8.7	Know that the ocean's temperature and pressure vary with depth.	8.7.1	Construct a graph that represents a typical vertical temperature profile in high, middle, and low latitudes.
		8.7.2	Construct a graph that represents a typical vertical pressure profile in high, middle, and low latitudes.

Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 8: The learner will have a basic understanding of the physical, chemical, and biological characteristics of the world's oceans.

Objectives	Measures
8.8 Know that sea water contains many dissolved substances.	8.8.1 Name the principle constituents of sea water. 8.8.2 Explain the term "salinity." 8.8.3 List the most abundant gases dissolved in ocean water. 8.8.4 Explain how temperature, salinity, and density are related in sea water.
8.9 Know that ocean waves have varied causes and characteristics.	8.9.1 Identify several major causes of ocean waves. 8.9.2 Describe ocean waves by their wavelength, height, and period. 8.9.3 Identify several types and causes of ocean waves. 8.9.4 Use diagrams to explain how wave energy travels through water, and what happens when a wave breaks.

Grade Level: 9-12

Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 8: The learner will have a basic understanding of the physical, chemical, and biological characteristics of the world's oceans.

Objectives	Measures
8.10 Know about the processes of shoreline modification and erosion by sea action.	8.10.1 Describe the shoreline as the midway point between high and low tide.
	8.10.2 Describe how the shoreline is constantly being modified by the action of such things as waves and longshore currents.
	8.10.3 Describe how violent and nonviolent wave action can erode large sections of a shoreline.
	8.10.4 Explain how coastal landscapes are changed by waves, tides, currents, winds, and tectonic action.
	8.10.5 Describe the general landform characteristics of neutral, submerged, and emergent shorelines.
	8.10.6 Give examples of several efforts to control shorelines such as sea walls and jetties, showing how natural systems have responded.
8.11 Know the causes, characteristics, and types of oceanic tides.	8.11.1 Describe, by use of models, how the earth, moon, and sun are positioned during spring and neap tide.
	8.11.2 Identify how tide heights are determined at specific locations around the world.
	8.11.3 Describe how the height of a tide is measured against a standard level.
	8.11.4 Identify tidal currents such as ebb and flood.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 9: The learner will have a general understanding of astronomy.

Objectives		Measures	
9.1	Know about instruments used to observe objects in space.	9.1.1	Know about instruments used to observe objects in space.
		9.1.2	Explain how different types of telescopes operate.
9.2	Be familiar with theories about the origin of the universe and how it has evolved.	9.2.1	Describe current theories of how the universe and its components have evolved to their present-day status.
		9.2.2	Describe current theories about the future of the universe.
9.3	Know about the solar system.	9.3.1	Create a model of the solar system comparing either relative sizes or relative distances.
		9.3.2	Identify several significant features of bodies within the solar system.
9.4	Know about the earth-moon system.	9.4.1	Demonstrate, using models, how the earth and moon move in relation to each other and the sun.
		9.4.2	Identify differences in time as events are observed from different vantage points (i.e., synodic and sidereal).
9.5	Know about space beyond the solar system.	9.5.1	Identify several objects or materials that have been observed or theorized within the known universe such as black holes, quasars, and nebulas.
		9.5.2	Describe the physical characteristics observed in celestial bodies such as stars, galaxies, and pulsars.
		9.5.3	Describe the life cycle of a star.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 10: The learner will have a general knowledge of space exploration.

Objectives	Measures
10.1 Know the principal events in the history of space exploration.	10.1.1 Write a report on the major events in the history of space travel.
	10.1.2 Explain several problems encountered in space exploration and tell how they were solved.
10.2 Know about the physical principles that control the motion of rockets in flight.	10.2.1 Describe the operation of the physical laws under which rockets function.
	10.2.2 Explain similarities and differences between solid- and liquid-fuel rockets.
10.3 Know about orbital and escape velocities.	10.3.1 Explain how escape velocity is related to the earth's gravity.
	10.3.2 Explain what is meant by orbital velocity and escape velocity.
10.4 Know about the history of satellites and space probes.	10.4.1 Describe several types of satellites that have been or are now in orbit.
	10.4.2 Explain several advantages and disadvantages of space probes as opposed to manned exploration.
	10.4.3 Recount several historical space probes and their accomplishments.
10.5 Know that space ventures have many implications for the future.	10.5.1 List at least three consumer products that have evolved from the space program.
	10.5.2 Write a report on the commercial aspects of NASA's space efforts.
	10.5.3 Identify future possibilities from space flight.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Earth Science--Academic

COMPETENCY GOAL 11: The learner will have a general understanding of natural resources and the environment.

Objectives	Measures
11.1 Know that the earth is a closed system in space with limited resources.	11.1.1 Explain some of the problems involved in population growth on the earth.
	11.1.2 Describe several effects of the overuse of the earth's renewable and nonrenewable resources.
	11.1.3 Describe several ways that people can minimize the depletion of the earth's resources.
11.2 Know that the earth's environment can be altered.	11.2.1 Describe the environment in terms of interrelated earth, air, and water systems.
	11.2.2 Describe several problems which could destroy the earth as an environment for people.
	11.2.3 Describe several environmental problems and suggest possible solutions.
	11.2.4 Describe several changes in people's behavior which could improve their chances for survival.

SCIENCE

Grade Level: 9-12

Skills/Subject Area: Earth Science--
Applied/Technical

COMPETENCY GOAL 1: The learner will have a general understanding of earth science.

Objectives	Measures
1.1 Know that earth science is a varied group of sciences employing many techniques to investigate the earth.	1.1.1 Define astronomy, geology, meteorology, climatology, and oceanography.
	1.1.2 List examples of common daily applications of knowledge in astronomy, geology, meteorology, climatology, and oceanography.
	1.1.3 Using a simple investigation, employ the experimental method to reach an acceptable solution.
	1.1.4 Describe instruments used to measure mass, volume, and temperature.
	1.1.5 Interpret data from tables, charts, and graphs.
1.2 Know that the earth is a body moving through space.	1.2.1 Discuss evidence of the earth's shape.
	1.2.2 Discuss evidence for the earth's motion in space such as the apparent motion of the stars, moon, or planets.
	1.2.3 Use a model to demonstrate the earth's rotation on its axis, and explain how day and night result from that motion.
	1.2.4 Demonstrate, using appropriate models, how seasons result from the motion of the earth around the sun.
1.3 Know that the earth's motions allow the precise location of places on the earth's surface and the determination of time.	1.3.1 Locate a given place on the earth's surface using latitude and longitude.
	1.3.2 Explain the time zone system using examples in the United States.
	1.3.3 Demonstrate the ability to read and use simple maps.

Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 1: The learner will have a general understanding of earth science.

Objectives		Measures	
1.4	Be aware of the various careers in the earth sciences.	1.4.1	List several careers in the earth sciences (geology, astronomy, meteorology, and oceanography).
		1.4.2	Obtain information from the library or guidance counselor on various careers in the earth sciences.
1.5	Know of recent advances in earth science and that these current issues affect society.	1.5.1	Cite several recent advances in the earth sciences.
		1.5.2	Cite media issues that deal with the earth sciences.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 2: The learner will have a general understanding of minerals.

Objectives	Measures
2.1 Have knowledge about the formation of minerals.	2.1.1 Explain how minerals form as magma cools.
	2.1.2 Demonstrate how minerals are formed by evaporation and precipitation.
2.2 Have knowledge about the composition of minerals.	2.2.1 Define the term "mineral."
	2.2.2 List basic properties of minerals.
	2.2.3 Name and identify some common minerals.
	2.2.4 Determine the hardness of several common minerals using Mohs' scale.

SCIENCE

Grade Level: 9-12

Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 3: The learner will have a general understanding of tectonics.

Objectives	Measures
3.1 Know about the composition of the earth.	3.1.1 Describe the properties of the earth's core, mantle, and lithosphere.
	3.1.2 Construct a model of the interior of the earth.
3.2 Know the processes of plate tectonics and diastrophism.	3.2.1 Explain the theory of plate tectonics.
	3.2.2 Discuss evidence of plate tectonics.
	3.2.3 Demonstrate, with models, how rocks respond to deformational forces.
	3.2.4 Demonstrate, using maps or models, the relationship between earthquakes and faults.
	3.2.5 Plot major earthquake epicenter data, for a period of time, on a world map and discuss their relationship to major fault locations.
3.3 Know how tectonic action causes volcanoes.	3.3.1 Demonstrate, with models or drawings, how chains of volcanoes are formed by crustal plate motion.
	3.3.2 Describe several types of volcanic eruptions.
	3.3.3 Describe good and bad effects volcanoes have on life.

SCIENCE

Grade Level: 9-12

Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 4: The learner will have a general understanding of geophysical processes.

Objectives	Measures
4.1 Know about igneous processes.	4.1.1 Identify some igneous rocks. 4.1.2 Relate cooling rate to crystal size. 4.1.3 Describe, using models, the process of igneous rock formation.
4.2 Know the processes of the sedimentary rock cycle.	4.2.1 Describe how sedimentary rocks are formed. 4.2.2 Give examples of depositional landforms. 4.2.3 Identify several types of sedimentary rocks. 4.2.4 Describe or demonstrate the process of compaction and cementation of sedimentary rocks.
4.3 Know about metamorphic rock formation.	4.3.1 Explain the basic changes that take place during metamorphism. 4.3.2 Recognize several types of metamorphic rocks.
4.4 Know variations and characteristics of landforms.	4.4.1 Give examples of several landforms such as mountains, sandbars, and canyons. 4.4.2 Construct a topographical or contour map. 4.4.3 Identify several landform types from topographic and contour maps. 4.4.4 Construct a model landscape from a contour or topographical map.

Grade Level: 9-12

Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 4: The learner will have a general understanding of geophysical processes.

Objectives	Measures
4.5 Know about weathering.	4.5.1 List examples of physical and chemical weathering.
	4.5.2 Demonstrate how wind erosion modifies surface features.
	4.5.3 Demonstrate how water erosion modifies surface features.
	4.5.4 Describe several features and processes related to glacial erosion.
4.6 Know about soil formation.	4.6.1 Explain the general composition of soil.
	4.6.2 Draw a soil profile and describe each component.
	4.6.3 Describe physical and chemical properties of soil.
	4.6.4 Describe several ways that people's activities accelerate soil erosion.
	4.6.5 Describe different soil types.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 5: The learner will have a general understanding of how the earth and its inhabitants have changed over time.

Objectives		Measures	
5.1	Know that our present understanding of geologic history is based, in part, on the theory of uniformitarianism.	5.1.1	Explain how a geologic time scale is developed using relative and absolute ordering of events.
		5.1.2	Explain some rules on which the relative ordering of geologic events is based.
5.2	Have knowledge of the geologic time scale.	5.2.1	Construct a scale model of geologic time.
		5.2.2	Demonstrate by a geologic time scale how people are recent, and perhaps temporary, figures in earth history.
		5.2.3	Identify the period and the organisms that produced coal and oil.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 6: The learner will have a basic understanding of meteorology.

Objectives		Measures	
6.1	Know the structure of the atmosphere.	6.1.1	Prepare a chart showing a vertical temperature profile of the atmosphere.
		6.1.2	List the major gases of the atmosphere.
		6.1.3	Explain why ozone is important to life on earth.
6.2	Know that energy from the sun is responsible for most of the processes on earth.	6.2.1	Describe the balance of incoming and outgoing radiation.
		6.2.2	Describe and demonstrate the "greenhouse effect."
6.3	Know about heat transfer processes.	6.3.1	Demonstrate and explain the characteristics of radiation, conduction, and convection.
		6.3.2	Give examples of each type of heat transfer.
6.4	Have knowledge of the causes and patterns of general atmospheric circulation.	6.4.1	Demonstrate air movements caused by differential heating of the earth's surface.
		6.4.2	Illustrate general atmospheric circulation.
		6.4.3	Describe causes and effects of sea and land breezes.
		6.4.4	Describe how people use knowledge of local wind effects.
		6.4.5	Describe how a windmill works.

Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 6: The learner will have a basic understanding of meteorology.

Objectives		Measures	
6.5	Have knowledge of the physical processes that cause clouds and precipitation.	6.5.1	Describe processes involved in cloud formation such as condensation and evaporation.
		6.5.2	Demonstrate the conditions necessary for cloud formation.
		6.5.3	Observe and identify cloud types.
6.6	Know characteristics of cyclones and anticyclones.	6.6.1	Describe the wind flow and atmospheric pressure conditions in cyclones and anticyclones.
		6.6.2	Describe general weather conditions with cyclones and anticyclones.
6.7	Know the various forms of severe weather conditions.	6.7.1	Describe characteristics of severe weather conditions such as thunderstorms, tornadoes, and hurricanes.
		6.7.2	Describe the safety precautions to be taken with violent storms including lightning.

Grade Level: 9-12

Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 6: The learner will have a basic understanding of meteorology.

Objectives	Measures
6.8 Know general characteristics of simple weather patterns and short-range forecasting.	6.8.1 Describe how a storm system forms.
	6.8.2 Trace the life cycle of a typical cyclone across the United States using standard weather maps and symbols.
	6.8.3 Measure and record atmospheric properties such as temperature, relative humidity, wind speed, accumulated rainfall, and atmospheric pressure.
	6.8.4 Identify the general pattern of weather systems in the Northern Hemisphere.
	6.8.5 Plot weather data on a map and predict weather conditions from the information.
	6.8.6 Describe common weather conditions that are associated with cold and warm fronts.
	6.8.7 Collect a consecutive series of newspaper weather maps and prepare local weather forecasts (wind, precipitation, clouds, and temperature) for each day; compare actual weather conditions with forecasted conditions.

SCIENCE

Grade Level: 9-12

Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 7: The learner will have a basic understanding of climate.

Objectives	Measures
7.1 Know the nature and physical factors of climate.	7.1.1 Explain the difference between weather and climate.
	7.1.2 Explain how geography affects climate.
7.2 Have knowledge of various types of climates.	7.2.1 Explain how climatologists learn about climate by studying long-term weather records.
	7.2.2 Describe climatic features of the local area.
	7.2.3 Describe a local microclimate.
7.3 Know how air pollution may affect the earth's climate.	7.3.1 Describe and discuss three major atmospheric pollutants, including their causes and effects.
	7.3.2 Prepare a poster or report to illustrate and explain areas of atmospheric pollution.
	7.3.3 Identify and report on the air pollution conditions in the local area.

SCIENCE

Grade Level: 9-12

Skills/Subject Area: Earth Science--
Applied/Technical

COMPETENCY GOAL 8: The learner will have a basic understanding of the physical, chemical, and biological characteristics of the world's oceans.

Objectives	Measures
8.1 Know about the study of oceanography.	8.1.1 Draw a submarine topographic map displaying several features such as the continental shelf, guyots, and canyons.
	8.1.2 Record simple measurements of a local body of water such as turbidity, surface and bottom temperatures.
	8.1.3 Describe instruments used to explore oceans such as Nansen bottles, bathythermographs, and sonar.
8.2 Know of the vastness of the world's oceans.	8.2.1 Prepare a poster or other visual aid to show a comparison between the land surface coverage and the water coverage of the earth.
	8.2.2 Develop several methods for describing total water on the earth.
8.3 Know how ocean water circulates.	8.3.1 Identify the primary cause for surface ocean currents.
	8.3.2 Make an illustration that shows major ocean current systems and the prevailing wind system that causes them.
	8.3.3 List the climatic effects and commercial implications for fishing due to upwelling.

Grade Level: 9-12 Page 2

Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 8: The learner will have a basic understanding of the physical, chemical, and biological characteristics of the world's oceans.

Objectives	Measures
8.4 Know how water is recycled through the natural process called the hydrologic cycle.	8.4.1 Demonstrate how water runs over and through the earth by using a sand and clay stream table.
	8.4.2 Show how plant transpiration is an important source of water vapor to the atmosphere.
	8.4.3 Demonstrate the process of distillation and explain its relationship to the hydrologic cycle.
	8.4.4 Diagram the hydrologic cycle.
8.5 Know about the topographic features of the undersea landscape.	8.5.1 Construct a relief map or drawing showing typical submarine topography such as canyons, trenches, and table mounts.
	8.5.2 Discuss similarities between terrestrial and submarine topography.
8.6 Know that many important resources are found in the ocean.	8.6.1 Prepare and present a report on sea resources.
	8.6.2 Identify regions on a map where specific ocean resources are located.
8.7 Know that the ocean's temperature and pressure vary with depth.	8.7.1 Construct a graph that represents a typical temperature and pressure profile.
	8.7.2 Discuss the cause for ocean surface temperature variation.

Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 8: The learner will have a basic understanding of the physical, chemical, and biological characteristics of the world's oceans.

Objectives		Measures	
8.8	Know that sea water contains many dissolved substances.	8.8.1	Identify the principal components of sea water.
		8.8.2	Describe the process of increasing salinity in sea water.
		8.8.3	Describe the importance of dissolved gases in sea water.
		8.8.4	Discuss the major source of dissolved oxygen in sea water.
8.9	Know that ocean waves have varied causes and characteristics.	8.9.1	List several causes of ocean waves.
		8.9.2	Describe the creation of a wind wave and a tsunami wave.
		8.9.3	Construct a diagram describing wave characteristics such as wavelength, height, and period.
		8.9.4	Describe the appearance and location of wind, swell, and surf waves.
8.10	Know about the processes of shoreline modification and erosion by sea action.	8.10.1	Describe the shoreline as the midway point between high and low tide.
		8.10.2	Explain how a shoreline is modified by waves and longshore currents.
		8.10.3	Prepare a report on the effects of a high surf on a shoreline.
		8.10.4	Discuss the pros and cons of attempts to control shoreline erosion.

Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 8: The learner will have a basic understanding of the physical, chemical, and biological characteristics of the world's oceans.

Objectives	Measures
8.11 Know about oceanic tides.	8.11.1 Describe, by use of models, how the earth, moon, and sun are positioned during spring and neap tide.
	8.11.2 Describe how tide heights are determined at specific locations around the world.
	8.11.3 Describe how the height of a tide is measured against a standard level.
	8.11.4 Identify tidal currents such as ebb and flood.

SCIENCE

Grade Level: 9-12

Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 9: The learner will have a general understanding of astronomy.

Objectives	Measures
9.1 Know about instruments used to observe objects in space.	9.1.1 List and describe instruments used to study objects in space.
	9.1.2 Discuss the history of the development of the telescope.
9.2 Become familiar with theories about the origin of the universe and how it has evolved.	9.2.1 Explain popular theories about the origin of the universe.
	9.2.2 Describe current theories about the future of the universe.
9.3 Know about the solar system.	9.3.1 Create a scale model of the solar system.
	9.3.2 Identify several significant features of bodies within the solar system.
9.4 Know about the earth-moon system.	9.4.1 Demonstrate, using models, how the earth and moon move in relation to each other.
	9.4.2 Describe, using models, the perigee and apogee of the moon orbit.
9.5 Know about space beyond the solar system.	9.5.1 Tell how stars have been, and currently are, used in navigation.
	9.5.2 Prepare and present a report on some aspect of the universe.

SCIENCE

Grade Level: 9-12

Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 10: The learner will have a general knowledge of space exploration.

Objectives	Measures
10.1 Know the principal events in the history of space exploration.	10.1.1 Make a presentation on space exploration.
	10.1.2 Explain problems encountered in space exploration.
10.2 Know about the physical principles that control the motion of rockets in flight.	10.2.1 Demonstrate how Newton's Laws apply to rocket flight.
	10.2.2 Describe the major features of a rocket.
10.3 Know about orbital and escape velocities.	10.3.1 Explain how escape velocity and orbital velocity are related to earth's gravity.
	10.3.2 Explain how deep space flights can be affected by planets.
10.4 Know about the history of satellites and space probes.	10.4.1 Sketch or draw space flights orbiting the earth or moving into deep space.
	10.4.2 Identify several reasons for having space vehicles and some of their advantages.
	10.4.3 Compare and contrast manned and unmanned space flights.
	10.4.4 Prepare and present a report on a particular space probe.
10.5 Know that space ventures have many implications for the future.	10.5.1 List several consumer products that have evolved directly or indirectly from the space program.
	10.5.2 Write a report on the commercial aspects of NASA's current flights.

SCIENCE

Grade Level: 9-12

Skills/Subject Area: Earth Science--Applied/Technical

COMPETENCY GOAL 11: The learner will have a general understanding of natural resources and the environment.

Objectives	Measures
11.1 Know that the earth is a closed system in space with limited resources.	11.1.1 Explain some of the problems involved in population growth on the earth.
	11.1.2 Describe several effects of the overuse of the earth's renewable and nonrenewable resources.
	11.1.3 Describe several ways that people can minimize the depletion of the earth's resources.
11.2 Know that the earth's environment can be altered.	11.2.1 Describe the environment in terms of interrelated earth, air, and water systems.
	11.2.2 Describe several problems which could destroy the earth as an environment for people.
	11.2.3 Describe several environmental problems and suggest possible solutions.
	11.2.4 Describe several changes in people's behavior which could improve their chances for survival.

Chemistry Outline

1. Introduction to the Science of Chemistry

    1.1 Methods and processes of science
    1.2 Properties of matter and energy
    1.3 Conservation of matter and energy

2. Matter--Classifications and Changes

    2.1 Classifications of matter
    2.2 Atoms and molecules
    2.3 Elements, compounds, and mixtures
    2.4 Nuclear changes
    2.5 Physical changes
    2.6 Chemical changes

3. Descriptive Chemistry and Periodic Properties of Elements

    3.1 Atomic models and electron configurations
    3.2 Periodic properties and the periodic table of elements

4. Measurement and Computation

    4.1 Use of number-producing instrumentation
    4.2 Scientific notation
    4.3 Units and conversions

5. Stoichiometry and Kinetic Molecular Theory

    5.1 Formulas and equations
    5.2 Mole concept
    5.3 Stoichiometry
    5.4 Behavior of gases

6. Chemical Reactions, Kinetics, and Thermodynamics

    6.1 Oxidation-reduction
    6.2 Electrochemistry
    6.3 Energy effects
    6.4 Reaction rates
    6.5 Equilibrium

7. Electrolyte Solutions--Acids, Bases, and Salts

    7.1 Importance
    7.2 Naming
    7.3 Characteristics and the solution process

    7.4 Systems of concentration
    7.5 Ionization
    7.6 Acid-base equilibria and pH
    7.7 Solubility

8. Organic Chemistry

    8.1 Carbon
    8.2 Hybridization and bonding
    8.3 Hydrocarbons
    8.4 Hydrocarbon substitution products
    8.5 Living things

9. Relevance and Current Topics in Chemistry

    9.1 Current topics
    9.2 Career opportunities

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Chemistry--Academic

COMPETENCY GOAL 1: The learner will have an understanding of the history, scope, basic concepts, and techniques related to the study of chemistry.

Objectives	Measures
1.1 Know and apply accepted methods, processes, and procedures for conducting scientific study.	1.1.1 Survey the history of early concepts of matter and energy.
	1.1.2 Relate and use terms and processes employed in scientific research.
	1.1.3 Study selected goals and attributes of pure and applied science.
	1.1.4 Participate in laboratory exercises illustrating scientific techniques of observation, measurement, and analysis.
	1.1.5 Produce written reports of laboratory exercises in accepted formats and use precise language for presentations of procedure, tables of data, graphs, analytical methods, results, and analyses of error.
	1.1.6 Conduct safe and accurate laboratory work.
1.2 Know the properties of matter and energy.	1.2.1 Describe the physical properties of matter such as linear dimensions, volume, weight, mass, shape, and physical state, through observation and experimentation.
	1.2.2 Explain the concepts of density and specific gravity after performing density experiments.
	1.2.3 Describe forms of energy such as mechanical, electrical, nuclear, and chemical.
1.3 Know the concept of conservation of matter and energy.	1.3.1 Describe the law of conservation of matter.
	1.3.2 Recognize that in any chemical reaction, neither energy nor matter is created or destroyed.

Grade Level: 9-12 Skills/Subject Area: Chemistry--Academic

COMPETENCY GOAL 2: The learner will understand systems of classification of matter, nuclear, physical, and chemical changes.

Objectives		Measures	
2.1	Know various descriptive classifications of matter.	2.1.1	Define a selected list of descriptive terms.
		2.1.2	Classify samples of matter with respect to: physical state, metallic and nonmetallic, and luster.
2.2	Know the basic chemical concepts of atoms and molecules.	2.2.1	Describe experimental evidence leading to particulate theories of matter.
		2.2.2	Relate the concepts of atoms and molecules using diagrams and symbols.
2.3	Know the concepts of elements, compounds, and mixtures.	2.3.1	Relate the concepts of atoms and molecules to the classification terms element, compound, and mixture.
		2.3.2	Identify samples of matter based upon this classification.
2.4	Know various types of nuclear changes.	2.4.1	Describe and use such terms as alpha and beta decay, fission, fusion, atomic mass and number, and chain reaction.
		2.4.2	Write balanced equations showing the conservation of mass and charge in a nuclear change.
2.5	Know about physical changes such as phase changes and the characteristics of these changes.	2.5.1	Determine the melting point of a chemical in the laboratory by graphing and interpreting the temperature-time data.
		2.5.2	Boil water, graph, and interpret the temperature-time data.

Grade Level: 9-12

Skills/Subject Area: Chemistry--Academic

COMPETENCY GOAL 2: The learner will understand systems of classification of matter, nuclear, physical, and chemical changes.

Objectives	Measures
2.6 Have knowledge of the nature and evidence of chemical changes.	2.6.1 Recognize and explain chemical changes that occur during selected reactions in terms of the recombinations of the atoms.
	2.6.2 Describe changes in terms such as endothermic and exothermic reactions, kindling temperature, spontaneous burning, and conditions necessary for combustion/oxidation.
	2.6.3 Observe certain aspects of a chemical change by examining the results of reacting weighed samples of iron and sulphur.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Chemistry--Academic

COMPETENCY GOAL 3: The learner will have an understanding of descriptive chemistry and periodic properties of elements.

Objectives		Measures	
3.1	Know descriptive terminology pertaining to atomic models and configurations of electrons.	3.1.1	Know experimentation and its interpretation leading to present-day models of the atom.
		3.1.2	Write a quantum number notation for the electrons of an atom with respect to quantum level, suborbital, and spin, given the atomic number of the element.
3.2	Know the origin and nature of the periodic properties of the elements, and the utility of the periodic table.	3.2.1	Relate position and numerical information on the periodic table to atomic number, mass, and electron configuration.
		3.2.2	Predict relative physical and chemical properties of elements from their position on the periodic chart.
		3.2.3	Locate and retrieve information from the periodic chart.
		3.2.4	Describe and verify in the laboratory certain physical and chemical properties of various families of elements.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Chemistry--Academic

COMPETENCY GOAL 4: The learner will understand concepts and techniques of measurement and computation as they relate to chemistry.

Objectives	Measures
4.1 Know how to measure accurately length, area, volume, mass, weight, temperature, and time, and record the measurements as precisely as the measuring devices permit.	4.1.1 Weigh objects and record the weight properly within the sensitivity limits.
	4.1.2 Measure liquid volumes within the precision of the container.
	4.1.3 Determine temperatures accurately and precisely.
	4.1.4 Determine the relationship between Celsius and Fahrenheit scales.
	4.1.5 Demonstrate the use of customary and metric units in measuring area, length, volume, mass, weight, temperature, and heat.
	4.1.6 Demonstrate applications of mathematical operations with respect to the concept of significant figures.
4.2 Know how to use scientific notation.	4.2.1 Write large and small numbers using scientific notation.
	4.2.2 Convert numbers written in scientific notation to common form.
	4.2.3 Perform multiple arithmetic operations involving numbers expressed in scientific notation.
4.3 Have a knowledge of mathematical operations involving manipulation of units and unit conversions.	4.3.1 Record data in the form of scalar numbers properly.
	4.3.2 Generate dimensionally correct answers when operating with scalar numbers.
	4.3.3 Interconvert quantities expressed in customary and metric units.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Chemistry--Academic

COMPETENCY GOAL 5: The learner will have an understanding of stoichiometry and kinetic molecular theory.

Objectives	Measures
5.1 Know how to construct and use chemical formulas and equations.	5.1.1 Relate chemical names and formulas.
	5.1.2 Write the reactants and products of a chemical reaction in the form of an equation.
	5.1.3 Balance a chemical equation by conservation of atoms, inspection.
5.2 Know how to use the mole concept.	5.2.1 Give the numerical value, derivation, and utility of Avogadro's number.
	5.2.2 Compute a formula weight given a periodic table.
	5.2.3 Relate the terms atomic weight, gram-atomic weight, molecular weight, gram-molecular weight.
5.3 Know how to make calculations involving stoichiometry given a periodic table and calculator.	5.3.1 Calculate the percentage by weight of a compound from its simplest formula.
	5.3.2 Calculate the simplest formula of a compound from the weight percentage of its elements.
	5.3.3 Calculate the stoichiometric amounts in specific reactions such as weight to weight, weight to volume, volume to weight, volume to volume.
	5.3.4 Make stoichiometric calculations in limiting reactant situations.
	5.3.5 Perform experiments to verify stoichiometric relationships.

Skills/Subject Area: Chemistry--Academic

COMPETENCY GOAL 5: The learner will have an understanding of stoichiometry and kinetic molecular theory.

Objectives	Measures
5.4 Know how to make calculations for the prediction of the behavior of gases.	5.4.1 Describe the behavior of a gas in terms of kinetic molecular theory. 5.4.2 Make calculations and laboratory verifications of the relationships of pressure, volume, and temperature. 5.4.3 Examine the stoichiometry of a gas collected by water displacement using Dalton's Law of Partial Pressures and the Ideal Gas Law. 5.4.4 Calculate the relative diffusion rates of various gases using Graham's Law.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Chemistry--Academic

COMPETENCY GOAL 6: The learner will understand fundamental principles related to chemical reactions, kinetics, and thermodynamics.

Objectives		Measures	
6.1	Know the concept of oxidation-reduction.	6.1.1	Write the oxidation numbers for each element in a compound.
		6.1.2	Identify and write the oxidation-reduction half reactions in a redox equation.
		6.1.3	Balance selected redox reactions by the electron-transfer method.
6.2	Have knowledge of basic principles in electrochemistry.	6.2.1	Calculate the cell voltage and direction of current flow in a sample cell given a table of standard oxidation or reduction potentials.
		6.2.2	Draw diagrams of current-producing and electroplating cells.
		6.2.3	Relate the stoichiometry of an electroplating cell to faradays of electricity, amperes of current, and time of operation.
6.3	Have knowledge of various energy effects in chemical reactions.	6.3.1	Identify and explain endothermic and exothermic reactions, using examples and graphs.
		6.3.2	Calculate amounts of heat consumed or evolved in a reaction using Hess' Law.
		6.3.3	Discuss the driving forces and spontaneity of a chemical reaction in terms of free energy, enthalpy, and entropy.

Skills/Subject Area: Chemistry--Academic

COMPETENCY GOAL 6: The learner will understand fundamental principles related to chemical reactions, kinetics, and thermodynamics.

Objectives	Measures
6.4 Know factors that affect the rate of a reaction.	6.4.1 Observe and explain the effects of temperature, surface area, catalysis, and other factors affecting reaction rates.
	6.4.2 Make laboratory investigations of factors affecting reaction rates.
6.5 Know the concept of dynamic equilibrium.	6.5.1 State the conditions necessary for equilibrium.
	6.5.2 State Le Chatelier's principle and predict the effects of various stresses upon a system in equilibrium.
	6.5.3 Write a generalized expression of an equilibrium constant.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Chemistry--Academic

COMPETENCY GOAL 7: The learner will have an understanding of the properties of electrolyte solutions.

Objectives	Measures
7.1 Know the importance of acids, bases, and salts in industry and in the home.	7.1.1 Identify ways common acids, bases, and salts may be used either in the home or in industry.
	7.1.2 Identify acids, bases, and salts on product labels.
7.2 Know the names and formulas of selected acids, bases, and salts.	7.2.1 Write chemical formulas for a variety of simple acids, bases, and salts.
	7.2.2 Identify the formulas of simple acids, bases, and salts.
7.3 Know physical characteristics and chemical properties of solutions of acids, bases, and salts.	7.3.1 State definitions of acids and bases according to the theories of Arrhenius, Bronsted-Lowry, and Lewis.
	7.3.2 Determine experimentally the pH, the effect on litmus paper, and other physical characteristics of acids, bases, and salts.
	7.3.3 Explain the characteristics of solutions of acids, bases, and salts in terms of interactions with water.
7.4 Know selected expressions of concentration of solutions.	7.4.1 Perform calculations involving molarity, normality, dilution factors, and acid-base titrations.
	7.4.2 Determine the concentration of a dilute acid solution in the laboratory by titration.
	7.4.3 Calculate the molarity, boiling point elevation, and freezing point depression of a solution.
	7.4.4 Observe the effects of concentration on the boiling point and freezing point of a solution.

Grade Level: 9-12

Skills/Subject Area: Chemistry--Academic

COMPETENCY GOAL 7: The learner will have an understanding of the properties of electrolyte solutions.

Objectives	Measures
7.5 Have a knowledge of the phenomenon of ionization.	7.5.1 Explain the ionization process in terms of the solution process and the equilibrium of water.
	7.5.2 Develop the concept of an ionization constant.
	7.5.3 Interpret a laboratory demonstration showing the degree of ionization of various solutions of electrolytes and nonelectrolytes.
7.6 Have a knowledge of acid-base equilibria and pH.	7.6.1 Develop an understanding of pH and pOH as logarithmic expressions of concentrations of hydronium and hydroxylions.
	7.6.2 Calculate the pH of an acidic or basic solution given its concentration.
7.7 Have knowledge of solubility equilibria.	7.7.1 Suggest ways to enhance or depress the solubility of a given substance.
	7.7.2 Write a statement for a specified solubility product constant.
	7.7.3 Perform calculations of the solubility product constant and ionic concentrations for solutions of sparingly soluble salts.
	7.7.4 Observe the precipitation from solution of sparingly soluble salts and learn to predict this occurrence using tables of solubility information.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Chemistry--Academic

COMPETENCY GOAL 8: The learner will have an understanding of the principles, reactions, and related compounds studied in organic chemistry.

Objectives		Measures	
8.1	Have knowledge of chemical properties, physical forms, and atomic structure of carbon.	8.1.1	Write the electron configuration of carbon.
		8.1.2	List several allotropic forms of carbon and describe their physical properties, occurrence, and use in the home and industry.
8.2	Have knowledge of hybridization and its relationship to bonding and molecular geometry.	8.2.1	Describe sigma and pi bonding.
		8.2.2	Sketch and relate structures based upon SP , SP , and SP hybrid carbon atoms to bonding types and bond angles.
8.3	Have knowledge of hydrocarbons.	8.3.1	Build and sketch models of the structure of simple alkanes, alkenes, alkynes, and ring compounds.
		8.3.2	Learn the I.U.P.A.C. system of nomenclature for simple hydrocarbons.
		8.3.3	Draw and label all structural isomers of hexane.
8.4	Have knowledge of major hydrocarbon substitution products.	8.4.1	Identify, name, and use various functional groups (alkyl, carbonyl, hydroxyl, carboxyl, amine) to produce formulas of common hydrocarbon derivatives.
		8.4.2	Sketch, build models, and name members of certain types of organic compounds such as organic acids, alcohols, aldehydes, alkyl halides, ketones, ethers, and esters.
8.5	Know that activities of living things involve chemical reactions.	8.5.1	Diagram and trace the photosynthesis process showing light and dark reactions.
		8.5.2	Trace the formation of proteins from DNA replication to RNA.

Grade Level: 9-12 Skills/Subject Area: Chemistry--Academic

COMPETENCY GOAL 9: The learner will have an understanding of the relevance of current topics in chemistry.

Objectives	Measures
9.1 Have knowledge of the relevance of current topics in chemistry.	9.1.1 Describe the use of computers in chemical analysis. 9.1.2 Discuss some of the recent advances in medicine. 9.1.3 Write equations that show how acid rain is formed. 9.1.4 Write equations showing the reaction of pollutants with ozone.
9.2 Be aware of careers available in chemistry.	9.2.1 Give a report on an interview with a research chemist. 9.2.2 Interview a high school chemistry teacher to find out what preparation is needed to become a chemistry teacher. 9.2.3 Prepare a report on a chemistry-related career.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Chemistry--Applied/Technical

COMPETENCY GOAL 1: The learner will understand the basic concepts and techniques of the study of chemistry.

Objectives	Measures
1.1 Know systematic processes for conducting scientific work.	1.1.1 Follow instructions in conducting safe and precise laboratory exercises.
	1.1.2 Communicate the results of laboratory experiments in an appropriate manner.
	1.1.3 Demonstrate an understanding of terms and operations in experimental work.
	1.1.4 Use selected laboratory equipment and number-producing instrumentation.
1.2 Know the properties of matter and energy.	1.2.1 Describe samples of matter in terms of mass, volume, density, and physical state.
	1.2.2 Observe and identify three forms of energy: heat, light, and sound.
	1.2.3 Use a lighted flashlight to demonstrate the transformation of energy from chemical to electrical, heat, and light.
	1.2.4 Give a report describing energy conversions in a gasoline engine.
1.3 Know the concept of conservation of matter and energy.	1.3.1 State that matter and energy are neither created nor destroyed.
	1.3.2 Observe and record the weights of reactants and products in the formation of iron sulfide.

SCIENCE

Grade Level: 9-12 **Skills/Subject Area:** Chemistry--Applied/Technical

COMPETENCY GOAL 2: The learner will understand systems of identification of matter, nuclear, physical, and chemical changes.

Objectives	Measures
2.1 Know various descriptive classifications of matter.	2.1.1 Match a selected list of descriptive terms with definitions.
	2.1.2 Classify samples of matter such as by physical state, and whether metallic or nonmetallic.
2.2 Know the basic chemical concepts of atoms and molecules.	2.2.1 Construct diagrams and models to illustrate the concepts.
	2.2.2 Relate the concepts of atoms and molecules using diagrams and symbols.
	2.2.3 Summarize the history of the concepts of atoms and molecules.
2.3 Know the concepts of elements, compounds, and mixtures.	2.3.1 Use the classification terms element, compound, mixture, and cite examples.
	2.3.2 Identify samples of matter based upon this classification.
	2.3.3 Produce a diagram relating elements, compounds, and mixtures.
2.4 Know various types of nuclear changes.	2.4.1 Describe and use the terms fission, fusion, atomic mass and number, and chain reaction.
	2.4.2 Explain the difference between a nuclear change and a chemical or physical change.

Skills/Subject Area: Chemistry--Applied/Technical

COMPETENCY GOAL 2: The learner will understand systems of identification of matter, nuclear, physical, and chemical changes.

Objectives		Measures	
2.5	Know about physical changes such as phase changes and characteristics of these changes.	2.5.1	Determine the melting point of a low-melting solid in the laboratory.
		2.5.2	Boil water and graph the temperature-time data.
		2.5.3	Observe and describe several allotropic forms of sulfur.
2.6	Have knowledge of the nature and evidence of chemical changes.	2.6.1	Explain selected chemical changes in terms of the recombinations of atoms.
		2.6.2	Describe chemical changes as endothermic or exothermic.
		2.6.3	Identify the chemical and physical changes that occur when weighed samples of iron and sulfur are reacted.

Grade Level: 9-12 Skills/Subject Area: Chemistry--Applied/Technical

COMPETENCY GOAL 3: The learner will understand descriptive chemistry and the periodic properties of elements.

Objectives		Measures	
3.1	Know descriptive terminology pertaining to atomic models and configurations of electrons.	3.1.1	Construct diagrams and models illustrating the present-day interpretation of the atom.
		3.1.2	Cite examples illustrating the scale of the linear dimensions of atom-sized particles.
3.2	Know the nature and utility of the periodic table.	3.2.1	Identify atomic number, mass, and electron configuration for a specified position on the periodic chart.
		3.2.2	Predict relative combining properties of elements from their position on the periodic chart.
		3.2.3	Locate and retrieve information from the periodic chart.
		3.2.4	Observe general physical and chemical properties of selected elements.
		3.2.5	Develop reports on the properties and uses of various elements and their compounds in some chemical families.
		3.2.6	Make a catalog of elements cited on product labels.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Chemistry--Applied/Technical

COMPETENCY GOAL 4: The learner will understand concepts and techniques of measurement and computation as they relate to chemistry.

Objectives	Measures
4.1 Know how to measure and record length, area, volume, mass, weight, temperature, and time.	4.1.1 Weigh objects and record the weight properly within the precision of the equipment.
	4.1.2 Measure liquid volumes within the precision of each container using flasks, cylinders, and beakers.
	4.1.3 Determine temperatures accurately and precisely using Celsius and Fahrenheit thermometers.
	4.1.4 Demonstrate the use of customary and metric units.
	4.1.5 Determine the linear dimensions, surface area, and volume of a series of objects with a metric ruler.
4.2 Know how to use scientific notation.	4.2.1 Write large and small numbers using scientific notation for even powers of 10.
	4.2.2 Convert numbers written in scientific notation to common form for even powers of 10.
4.3 Have knowledge of mathematical operations involving manipulation of units and unit conversions.	4.3.1 Record data in the form of scalar numbers.
	4.3.2 Develop a personal catalog of conversion factors.
	4.3.3 Interconvert quantities expressed in customary and metric units using calculators, conversion aids, and tables of conversion factors.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Chemistry--Applied/Technical

COMPETENCY GOAL 5: The learner will have an understanding of stoichiometry and kinetic molecular theory.

Objectives	Measures
5.1 Know how to construct and use chemical formulas and equations.	5.1.1 Relate chemical names and formulas.
	5.1.2 Write simple chemical reactions.
	5.1.3 Balance a short chemical equation by inspection.
5.2 Know how to use the mole concept.	5.2.1 Explain the utility of the mole concept.
	5.2.2 Compute the formula weight of a formula containing no more than a single subscript.
5.3 Know how to make calculations involving stoichiometry given a periodic table and a calculator.	5.3.1 Calculate the percentage by weight of a compound from its simplest formula that contains no more than a single subscript.
	5.3.2 Calculate the stoichiometric weights in a specified reaction from the balanced equation.
	5.3.3 Describe a limiting reactant situation.
	5.3.4 Perform experiments to verify stoichiometric weight relationships.
5.4 Know how to make calculations for the prediction of the behavior of gases.	5.4.1 Make calculations and laboratory verifications of the relationships of pressure, volume, and temperature.
	5.4.2 Collect samples of gases by water displacement.
	5.4.3 Examine instruments and formulate methods of measuring pressures and volumes of gases.
	5.4.4 Use units for the measurement of pressure and volume of gases.

Grade Level: 9-12 Skills/Subject Area: Chemistry--Applied/Technical

COMPETENCY GOAL 6: The learner will understand fundamental principles related to chemical reactions, kinetics, and thermodynamics.

Objectives	Measures
6.1 Know about the concept of oxidation-reduction.	6.1.1 Write the oxidation numbers for each element in a compound that contains no more than one complex ion.
	6.1.2 Identify oxidation-reduction equations.
6.2 Have knowledge of basic principles in electrochemistry.	6.2.1 Calculate the cell voltage in a sample cell given a table of standard oxidation or reduction potentials.
	6.2.2 Draw a diagram of an electroplating cell.
	6.2.3 Construct current-producing and electroplating cells.
	6.2.4 Describe corrosion between dissimilar metals.
6.3 Have knowledge of various energy effects in a chemical reaction.	6.3.1 Identify and explain endothermic and exothermic reactions in terms of heat consumed and lost.
	6.3.2 Describe an endothermic and exothermic reaction in the laboratory.
	6.3.3 Discuss the driving forces of a chemical reaction (enthalpy and entropy).
6.4 Have knowledge of factors that affect the rate of a reaction.	6.4.1 Observe the effects of temperature and surface area on reaction rates.
	6.4.2 Discuss other factors that affect reaction rates.
6.5 Know about the concept of dynamic equilibrium.	6.5.1 Describe and cite examples of an equilibrium.
	6.5.2 State Le Chatelier's principle and give examples of stresses upon a system in equilibrium.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Chemistry--Applied/Technical

COMPETENCY GOAL 7: The learner will have an understanding of the properties of electrolyte solutions.

Objectives	Measures
7.1 Know the importance of acids, bases, and salts in industry and in the home.	7.1.1 Identify ways that certain common acids, bases, and salts are used in the home or in industry.
	7.1.2 Identify acids, bases, and salts on product labels.
7.2 Know the names and formulas of selected acids, bases, and salts.	7.2.1 Write chemical formulas for selected simple acids, bases, and salts.
	7.2.2 Write the formulas of selected simple acids, bases, and salts when given the chemical name.
7.3 Know physical characteristics and chemical properties of solutions of acids, bases, and salts.	7.3.1 Observe the effects of solutions of acids, bases, and certain salts on litmus paper and pH paper.
	7.3.2 Explain the characteristics of solutions of acids, bases, and salts, and neutralization reactions.
7.4 Have knowledge of selected expressions of concentration of solutions.	7.4.1 Perform calculations involving molarity and dilution factors.
	7.4.2 Determine the concentration of a dilute acid solution in the laboratory by titration with standard base.
	7.4.3 Discuss boiling point elevation and freezing point depression of a solution and its relation to the labels and tables on an antifreeze can.
	7.4.4 Observe the effects of concentration on the boiling point of a water solution.

Skills/Subject Area: Chemistry--Applied/Technical

COMPETENCY GOAL 7: The learner will have an understanding of the properties of electrolyte solutions.

Objectives		Measures	
7.5	Know about the phenomenon of ionization.	7.5.1	Explain the ionization process in terms of the solution process in water.
		7.5.2	Observe a laboratory demonstration of solutions of electrolytes and nonelectrolytes.
7.6	Have knowledge of acids, bases, and pH.	7.6.1	Draw a diagram of pH and pOH scales and give examples of everyday materials in the corresponding ranges.
		7.6.2	Determine the pH of an acidic or basic solution given a pH meter or test kit.
7.7	Know about solubility.	7.7.1	Suggest ways to enhance or depress the solubility of a given substance.
		7.7.2	Observe the precipitation from solution of sparingly soluble salts.
		7.7.3	Recapture filtrates and centrifugates in the laboratory.

SCIENCE

Grade Level: 9-12

Skills/Subject Area: Chemistry--Applied/Technical

COMPETENCY GOAL 8: The learner will have a general understanding of organic chemistry.

Objectives		Measures	
8.1	Have knowledge of chemical properties, physical forms, and atomic structure of carbon.	8.1.1	Describe selected carbon compounds.
		8.1.2	Observe physical properties and discuss the uses of graphite, diamond, and amorphous carbon.
		8.1.3	Describe the combustion of carbon compounds.
8.2	Know about hybridization and its relationship to bonding and molecular geometry.	8.2.1	Describe the unique geometry of carbon bonding.
		8.2.2	Sketch and relate structures based upon single, double, and triple bonds.
8.3	Know about hydrocarbons.	8.3.1	Learn the I.U.P.A.C. system of nomenclature for simple alkanes.
		8.3.2	Draw structures and cite examples of structural isomers.

Grade Level: 9-12

Skills/Subject Area: Chemistry--Applied/Technical

COMPETENCY GOAL 8: The learner will have a general understanding of organic chemistry.

Objectives	Measures
8.4 Know about major hydrocarbon substitution products.	8.4.1 Identify names of common organic acids and alcohols.
	8.4.2 Identify generalized structures of certain types of organic compounds such as organic acids, alcohols, aldehydes, alkyl halides, ketones, ethers, esters (e.g., ROR = ether).
	8.4.3 Learn to associate group names with suffixes in the I.U.P.A.C. system of nomenclature for simple hydrocarbons (e.g., 2-propanone is a ketone).
	8.4.4 Identify selected functional groups (alkyl, carbonyl, hydroxyl, carboxyl, amine).
	8.4.5 Sketch and build models of simple examples of organic compounds such as organic acids, alcohols, aldehydes, alkyl halides, ketones, ethers, and esters.
	8.4.6 Identify household products with their related organic groups.
8.5 Know activities of living things involve chemical reactions.	8.5.1 Label a diagram tracing the photosynthesis process.
	8.5.2 Discuss the formation of proteins.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Chemistry--Applied/Technical

COMPETENCY GOAL 9: The learner will understand the relevance of current topics in chemistry.

Objectives	Measures
9.1 Have a knowledge of the relevance of current topics in chemistry.	9.1.1 Describe the use of computers in chemistry.
	9.1.2 Discuss some of the recent advances in medicine.
	9.1.3 Describe the causes and effects of acid rain.
	9.1.4 Write the formula for and discuss environmental issues related to atmospheric ozone.
9.2 Be aware of careers available in chemistry.	9.2.1 Give a report on an interview with a pharmacist.
	9.2.2 Interview a chemistry teacher and discuss the preparation needed to become a chemistry teacher.
	9.2.3 Report on the operation of a municipal water plant.

Physics Outline

1. Introduction to the Science of Physics

   1.1 Problem-solving methods
   1.2 Measuring devices and scalar numbers
   1.3 Elements of graph construction
   1.4 Relevance and current topics in physics

2. Mechanics

   2.1 Laws of motion
   2.2 Vector quantities and component forces
   2.3 Gravitational forces
   2.4 Work, power, and mechanical energy

3. Kinetic Theory and Properties of Matter

   3.1 Phases of matter
   3.2 Use of physical constants

4. Thermodynamics

   4.1 Characteristics of heat energy
   4.2 Conservation of heat
   4.3 Heat equivalent of work

5. Wave Mechanics

   5.1 General properties of wave phenomena
   5.2 Sound
   5.3 Light

6. Electricity and Magnetism

   6.1 Electrostatic phenomena
   6.2 Direct current circuits
   6.3 Magnetism
   6.4 Alternating current

7. Particle Physics

   7.1 Development of atomic theory
   7.2 Quantum theory
   7.3 Atomic particles
   7.4 Nuclear energy and society

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physics--Academic

COMPETENCY GOAL 1: The learner will understand the science of physics and how it affects our lives.

Objectives	Measures
1.1 Know how to solve problems using basic algebra and trigonometry.	1.1.1 Solve algebraic equations utilizing mathematical formulas and expressions.
	1.1.2 Solve right triangle problems using sine, cosine, and tangent.
	1.1.3 Solve triangle problems using sine and cosine law.
1.2 Know how to use measuring devices and scalar numbers.	1.2.1 Use various measuring instruments in laboratory situations.
	1.2.2 Describe certain aspects of coherent systems of units with respect to British Engineering and SI Metric Systems.
	1.2.3 Interconvert expressions of like quantities in different units.
	1.2.4 Demonstrate accuracy and precision in computing and measuring when doing laboratory experiments.
	1.2.5 Determine answers to measurement problems to the correct number of significant figures.
	1.2.6 Calculate expressions of precision (e.g., average deviation, percent deviation) and accuracy (e.g., absolute error, percent error).
	1.2.7 Use laboratory equipment employing exponential scales.
	1.2.8 Perform multiple arithmetic operations and solve algebraic equations involving numbers expressed in scientific notation.

Grade Level: 9-12

Skills/Subject Area: Physics--Academic

COMPETENCY GOAL 1: The learner will understand the science of physics and how it affects our lives.

Objectives		Measures	
1.3	Understand the elements of graph construction.	1.3.1	Collect and present data in a systematic fashion.
		1.3.2	Graph and interpret data collected from a laboratory exercise.
		1.3.3	Express in mathematical statements information obtained from a graph of laboratory data.
1.4	Know of recent advances, career potentials, and current societal issues in physics.	1.4.1	Critique an article on a recent advance in physics.
		1.4.2	Report on a possible career in physics.
		1.4.3	Suggest an impact of recent advances in physics on society.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physics--Academic

COMPETENCY GOAL 2: The learner will understand basic mechanics.

Objectives	Measures
2.1 Know laws, mathematical expressions, and factors which represent and affect various types of motion.	2.1.1 Make calculations involving velocity, acceleration, momentum, work, and power.
	2.1.2 Define and use vector and scalar quantities.
	2.1.3 Solve problems relating time, distance, velocity, and acceleration for bodies in linear motion.
	2.1.4 Solve problems relating time, angular distance, torque, rotational inertia, angular velocity, and angular acceleration for bodies in circular and rotary motion.
	2.1.5 Perform laboratory investigations of free-fall motion.
	2.1.6 Solve problems and perform laboratory investigations of the motion of a simple pendulum.
	2.1.7 Write systematic, well-formulated reports of laboratory work.
	2.1.8 Explore applications of a microprocessor to the analysis of laboratory data and simulation of mechanical phenomena.

Grade Level: 9-12 Page 2

Skills/Subject Area: Physics--Academic

COMPETENCY GOAL 2: The learner will understand basic mechanics.

Objectives		Measures	
2.2	Know how to analyze systems involving vector quantities and component forces.	2.2.1	Resolve problems involving motion vectors for direction and magnitude.
		2.2.2	Resolve problems involving force vectors for the direction and magnitude of the equilibrant force.
		2.2.3	Investigate equilibrant forces in a laboratory setting using a force table.
		2.2.4	Solve problems involving frictional forces and coefficients of friction.
		2.2.5	Investigate the frictional forces and the coefficients of static and sliding friction of a block on an inclined plane.
		2.2.6	Solve problems relating to torque.
		2.2.7	Analyze a system of torque-producing forces acting on a beam in equilibrium in the laboratory.
2.3	Understand the behavior of gravitational forces.	2.3.1	State Newton's Law of Universal Gravitation.
		2.3.2	Solve problems relating gravitational forces, mass, distance, the Universal Gravitational Constant, and acceleration due to gravity.

Grade Level: 9-12 Page 3

Skills/Subject Area: Physics--Academic

COMPETENCY GOAL 2: The learner will understand basic mechanics.

Objectives	Measures
2.4 Know how to quantify work, power, and mechanical energy.	2.4.1 Perform calculations and laboratory determinations of work, power, momentum, and impulse.
	2.4.2 Observe and describe the conservation of momentum for elastic and inelastic collisions.
	2.4.3 Perform calculations and laboratory determinations of rotary work and power, angular momentum, and impulse.
	2.4.4 Calculate the potential and kinetic energy of a body at rest and in motion.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physics--Academic

COMPETENCY GOAL 3: The learner will understand kinetic theory and have a general knowledge of properties of matter.

Objectives	Measures
3.1 Understand phases of matter in terms of the kinetic molecular theory.	3.1.1 Perform calculations and laboratory investigations of tensile and compressional forces on solids including determinations of Hooke's Law, Young's Modulus, and tensile strength.
	3.1.2 Observe the effects of pressure, surface tension, and capillary action in liquids.
	3.1.3 Solve problems and conduct laboratory investigations of gas laws relating volume, temperature, and pressure.
3.2 Know how to use indexed information relating to physical constants.	3.2.1 Demonstrate the ability to retrieve information from standard publications of physical constants such as the C.R.C. or Lange's tables.
	3.2.2 Develop a table of physical constants in the laboratory.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physics--Academic

COMPETENCY GOAL 4: The learner will understand elementary principles of thermodynamics.

Objectives	Measures
4.1 Understand factors associated with the characteristics of heat.	4.1.1 Measure and distinguish the temperature from the heat content of a body.
	4.1.2 Measure and explain heat transfer by conduction, convection, and radiation.
	4.1.3 Relate the effects of thermal energy to kinetic molecular theory.
	4.1.4 Calculate the quantity of heat needed to produce a specified temperature change.
4.2 Know how to quantify the conservation of heat.	4.2.1 Determine the heat gain/loss and specific heat of an object in the laboratory using a calorimeter.
	4.2.2 Explain phase changes based upon laboratory data and graphs.
	4.2.3 Calculate the equilibrium temperature of a two-component mixture.
4.3 Know how to make determinations of the heat equivalent of work.	4.3.1 Observe and discuss the energy conversions in the operation of a model steam engine.
	4.3.2 Calculate the work to be derived from a specified fuel.
	4.3.3 Calculate the efficiency of an engine.
	4.3.4 Relate potential and kinetic energy to their heat equivalents.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physics--Academic

COMPETENCY GOAL 5: The learner will understand basic elements of wave mechanics.

Objectives	Measures
5.1 Understand the general properties of wave phenomena.	5.1.1 Identify, diagram, and calculate quantities relating to wave velocity, wavelength, and frequency.
	5.1.2 Describe types of wave phenomena and modes of propagation.
	5.1.3 Describe reflection, refraction, diffraction, and interference.
	5.1.4 Describe standing waves with respect to loops and nodes.
	5.1.5 Observe and illustrate wave phenomena using various types of equipment (e.g., ripple tank, slinky, soft rope, signal generator, and oscilloscope).
5.2 Know how to investigate and describe sound in a quantified manner.	5.2.1 Explain with graphs and make calculations relating loudness and sound intensity.
	5.2.2 Make calculations relating velocity, wavelength, frequency, and period of sound waves.
	5.2.3 Demonstrate and make calculations of frequency relating to the Doppler effect.
	5.2.4 Calculate and verify the time for an echo return.
	5.2.5 Demonstrate the descriptive terms that can be applied to sound waves on a musical instrument.

Grade Level: 9-12

Skills/Subject Area: Physics--Academic

COMPETENCY GOAL 5: The learner will understand basic elements of wave mechanics.

Objectives	Measures
5.3 Know how to investigate and describe light in a quantified manner.	5.3.1 Label a chart of the electromagnetic spectrum.
	5.3.2 Know the speed of light and make calculations relating this speed to distance and time.
	5.3.3 Demonstrate the relationship of distance and intensity.
	5.3.4 Make calculations relating to intensity, flux, and illumination (normal and inclined).
	5.3.5 Investigate the measurement of light intensity using a Bunsen or Joly photometer.
	5.3.6 Investigate calculations of the refraction of light relating to the speed of light in a medium, index of refraction, and angles of incidence and refraction (Snell's Law).
	5.3.7 Make calculations and construct ray diagrams relating focal length, image distance, and object distance for spherical mirrors and lenses.
	5.3.8 Make laboratory investigations of spherical mirrors and lenses.
	5.3.9 Calculate the magnification power of simple magnifiers.
	5.3.10 Make calculations and laboratory investigations of the wavelength of light using a diffraction grating and laser or monochromatic light source.
	5.3.11 Investigate polarized light using various polarizing filters and dichroic crystals.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physics--Academic

COMPETENCY GOAL 6: The learner will understand basic principles of electricity and magnetism.

Objectives	Measures
6.1 Know how to identify and quantify certain electrostatic phenomena.	6.1.1 Conduct laboratory investigations of basic laws of electrostatic attraction/repulsion and charge transfer.
	6.1.2 Make calculations related to electrostatic forces, charge, distance, and field intensity.
	6.1.3 Make calculations relating potential, stored charge, and capacitance, for capacitors in series and parallel.
6.2 Understand basic quantities and components associated with direct current circuits.	6.2.1 Make calculations and laboratory verifications of Ohm's Law.
	6.2.2 Make calculations and laboratory investigations of circuits containing resistors in series and parallel.
	6.2.3 Draw charts and schematic diagrams of simple electrical circuits.
	6.2.4 Relate Ohm's Law to cells in series and parallel circuits.
	6.2.5 Determine the value of an unknown resistor using a Wheatstone bridge.
	6.2.6 Relate the power expended in a circuit to resistance and current.
	6.2.7 Make calculations and laboratory verifications of electrochemical phenomena related to time, current, and mass of material transferred in an electroplating circuit.

Grade Level: 9-12

Skills/Subject Area: Physics--Academic

COMPETENCY GOAL 6: The learner will understand basic principles of electricity and magnetism.

Objectives	Measures
6.3 Understand basic terms and phenomena associated with magnetism.	6.3.1 Explain, using diagrams, the origin of magnetic phenomena.
	6.3.2 Show the N-S conventions in diagrams describing magnets and magnetic flux lines.
	6.3.3 Make calculations relating flux density near a straight conductor to current flow and distance.
	6.3.4 Demonstrate the "left-hand" rule for straight conductors and solenoids.
	6.3.5 Make a laboratory determination of the strength of the earth's magnetic field using a tangent galvanometer.
	6.3.6 Calculate the strength of an electromagnet related to current flow and number of turns.
	6.3.7 Demonstrate use of the "right-hand" motor rule and the "left-hand" generator rule in relating armature spin, field direction, and current flow.
	6.3.8 Describe basic types of motors and generators.
	6.3.9 Describe the operation of a transformer and quantify the relationship of primary and secondary voltages to numbers of turns.
6.4 Understand basic descriptive material pertaining to alternating current circuits.	6.4.1 Describe effective voltage, effective current, phased current, inductance, power angle, and impedance as they relate to alternating-current circuits.
	6.4.2 Describe some basic principles associated with vacuum tube and transistor circuits and their relationships to certain electronic devices.

Grade Level: 9-12 Skills/Subject Area: Physics--Academic

COMPETENCY GOAL 7: The learner will understand some fundamental concepts of particle physics.

Objectives	Measures
7.1 Know about atomic theory and its development.	7.1.1 List and explain the major aspects of the atomic theory. 7.1.2 Discuss the contributions of various scientists to the atomic theory.
7.2 Know about major aspects of quantum theory.	7.2.1 Discuss the development of the quantum theory beginning with the Bohr model. 7.2.2 Assign quantum numbers to the electrons of given atoms. 7.2.3 Discuss how quantum theory is used to explain atomic structure. 7.2.4 Identify some of the mathematical equations used in the theory.
7.3 Understand the properties and functions of major atomic particles.	7.3.1 Give a description of the roles that some particles play in the atom. 7.3.2 Balance selected nuclear equations with respect to mass and charge. 7.3.3 Calculate the half-life of selected radioactive substances.
7.4 Know about practical applications of nuclear energy.	7.4.1 List uses of nuclear energy in medicine, research, and manufacturing. 7.4.2 Discuss the significance of nuclear energy to society.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physics--Applied/Technical

COMPETENCY GOAL 1: The learner will understand the science of physics and how it affects our lives.

Objectives	Measures
1.1 Know how to solve problems using basic algebra and geometry.	1.1.1 Solve algebraic equations and formulas with three variables (e.g., $V = IR$).
	1.1.2 Show proficiency in the use of a hand calculator.
	1.1.3 Calculate areas and volumes of regular solids.
1.2 Know how to use measuring devices and scalar numbers.	1.2.1 Use various measuring instruments in laboratory situations.
	1.2.2 Interconvert expressions of like quantities in different units using tables and charts.
	1.2.3 Demonstrate accuracy and precision in computing and measuring.
	1.2.4 Use laboratory equipment employing vernier scales.
	1.2.5 Solve problems involving multiple arithmetic operations.
	1.2.6 Measure an angle in degrees.

Skills/Subject Area: Physics--Applied/Technical

COMPETENCY GOAL 1: The learner will understand the science of physics and how it affects our lives.

Objectives		Measures
1.3 Know the elements of graph construction.	1.3.1	Record data in an appropriate format.
	1.3.2	Interpret data collected from a laboratory exercise.
	1.3.3	Interpret information obtained from a graph of laboratory data.
	1.3.4	Show competence in point plotting and graph reading.
	1.3.5	Understand issues pertaining to closeness of measurement, doubtful digits, and rounding off numbers.
1.4 Know of recent advances, career potentials, and current societal issues in physics.	1.4.1	List career opportunities available in physics.
	1.4.2	Debate societal issues such as nuclear energy or weapons.
	1.4.3	Select examples for reports from newspapers, magazines, and TV of recent discoveries and advances in physics.

Grade Level: 9-12 Skills/Subject Area: Physics--Applied/Technical

COMPETENCY GOAL 2: The learner will understand basic mechanics.

Objectives	Measures
2.1 Identify the laws and mathematical expressions pertaining to motion.	2.1.1 State laws and mathematical expressions related to work and power (e.g., W = F x d and P = w/t).
	2.1.2 Define vector and scalar quantities.
	2.1.3 Solve problems relating time, distance, and velocity for bodies in linear motion (e.g., d = vt).
	2.1.4 Investigate the length-time graph of a burning candle.
	2.1.5 Solve problems relating to torque (e.g., T = F x d).
	2.1.6 Produce a distance-time graph for a body in free-fall motion.
	2.1.7 Explain acceleration in terms of distance-time graphs.
	2.1.8 Describe the forces affecting the movement of a motor vehicle.
	2.1.9 Explain the use of the constant of acceleration of gravity.
	2.1.10 Solve problems and perform laboratory investigations of the motion of a simple pendulum.
	2.1.11 Write reports of laboratory work that include tables and graphs.
	2.1.12 Explore applications of a microprocessor to the simulation of mechanical phenomena.
	2.1.13 State predictions of what may occur as a result of technology.
	2.1.14 Research and summarize how technology has changed the way leisure is used.

Grade Level: 9-12

Skills/Subject Area: Physics--Applied/Technical

COMPETENCY GOAL 2: The learner will understand basic mechanics.

Objectives	Measures	
2.2 Know how to analyze systems involving vector quantities and component forces.	2.2.1	Resolve problems involving motion vectors at right angles using graphs.
	2.2.2	Resolve problems involving force vectors at right angles using graphs.
	2.2.3	Investigate equilibrant forces in a laboratory setting using a force table and develop a series of diagrams to summarize the results.
	2.2.4	Point out when friction is necessary and when it must be reduced.
	2.2.5	List means of reducing friction.
	2.2.6	Solve problems involving frictional forces and coefficients of static friction on a level surface.
	2.2.7	Investigate frictional forces and coefficients of static friction.
	2.2.8	Solve problems relating to force and distance from the fulcrum of a first-class lever.
	2.2.9	Investigate a torque-producing force acting on a beam.
2.3 Know the behavior of gravitational forces.	2.3.1	State Newton's Law of Universal Gravitation.
	2.3.2	Describe situations relating gravitational force to: planetary motions, acceleration due to gravity, and weight vs. mass.

Grade Level: 9-12

Skills/Subject Area: Physics--Applied/Technical

COMPETENCY GOAL 2: The learner will understand basic mechanics.

Objectives	Measures
2.4 Know how to quantify work, power, and mechanical energy.	2.4.1 Perform calculations and laboratory determinations of work and power.
	2.4.2 Observe the conservation of momentum for elastic and inelastic collisions.
	2.4.3 Explain potential and kinetic energy.
	2.4.4 Calculate the potential energy of a mass at various heights ($E = mgh$).
	2.4.5 Demonstrate a knowledge of simple machines.
	2.4.6 Identify simple machines found in the work place.
	2.4.7 Relate gear systems to the operation of motor vehicles and bicycles.
	2.4.8 Relate energy transfer to the drive train of an automobile.

Grade Level: 9-12 Skills/Subject Area: Physics--Applied/Technical

COMPETENCY GOAL 3: The learner will have a general knowledge of kinetic theory and properties of matter.

Objectives		Measures	
3.1	Know about phases of matter in terms of the kinetic molecular theory.	3.1.1	Perform laboratory investigations of tensile and compressional forces on solids and discuss determinations of Hooke's Law, Young's Modulus, and tensile strength.
		3.1.2	Determine the elastic constant of a spring in the laboratory.
		3.1.3	Observe the effects of pressure, surface tension, and capillary actions in liquids.
		3.1.4	Conduct laboratory investigations of gas laws relating volume, temperature, and pressure.
3.2	Know how to use indexed information relating to physical constants.	3.2.1	Develop and use a personal table of conversion factors.
		3.2.2	Develop a table of physical constants in the laboratory.

Grade Level: 9-12 Skills/Subject Area: Physics--Applied/Technical

COMPETENCY GOAL 4: The learner will understand elementary principles of thermodynamics.

Objectives	Measures
4.1 Understand factors associated with the characteristics of heat.	4.1.1 Distinguish the temperature from the heat content of a body.
	4.1.2 Explain heat transfer by conduction, convection, and radiation.
	4.1.3 Relate the effects of thermal energy to kinetic molecular theory.
	4.1.4 Calculate the quantity of heat needed to produce a specified temperature change in a quantity of water.
4.2 Know how to quantify the conservation of heat.	4.2.1 Determine the heat gain/loss of a metal object in the laboratory using a calorimeter.
	4.2.2 Explain phase changes incorporating discussions of latent heats of fusion and vaporization.
	4.2.3 Plot a cooling curve of a liquid-solid phase change.
	4.2.4 Relate laws of thermodynamics to the heating/cooling of a building.

Skills/Subject Area: Physics--Applied/Technical

COMPETENCY GOAL 4: The learner will understand elementary principles of thermodynamics.

Objectives	Measures
4.3 Know how to make determinations of the heat equivalent of work.	4.3.1 Observe and discuss the energy conversions in the operation of a model steam engine.
	4.3.2 Calculate the heat to be derived from a given amount of a specified fuel.
	4.3.3 Give examples of matter that are energy sources.
	4.3.4 List and describe the use of turbines in energy conversion.
	4.3.5 Operate, manipulate, and/or distinguish between two and four cycle internal combustion engines.
	4.3.6 Compare and contrast gasoline and diesel engines.
	4.3.7 Explain why engines must have some means of cooling themselves.

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physics--Applied/Technical

COMPETENCY GOAL 5: The learner will understand basic elements of wave mechanics.

Objectives	Measures
5.1 Know the general properties of wave phenomena.	5.1.1 Identify quantities relating to wave velocity, wavelength, and frequency using diagrams.
	5.1.2 Describe types of wave phenomena.
	5.1.3 Describe reflection, refraction, and interference.
	5.1.4 Describe standing waves with respect to loops and nodes.
	5.1.5 Observe and illustrate wave phenomena using various types of equipment (e.g., ripple tank, slinky, soft rope, signal generator, and oscilloscope).
	5.1.6 Differentiate between mechanical and electromagnetic waves.
5.2 Know how to investigate and describe sound in a quantified manner.	5.2.1 Explain the difference between loudness and sound intensity.
	5.2.2 Make calculations relating velocity, wavelength, and frequency of sound waves (velocity = frequency x wavelength).
	5.2.3 Demonstrate and explain the Doppler effect.
	5.2.4 Determine the time for an echo return.
	5.2.5 Demonstrate changes of frequency of sound on various musical instruments.

Grade Level: 9-12

Skills/Subject Area: Physics--Applied/Technical

COMPETENCY GOAL 5: The learner will understand basic elements of wave mechanics.

Objectives		Measures	
5.3	Know how to investigate and describe light in a quantified manner.	5.3.1	Label a chart of the electromagnetic spectrum.
		5.3.2	Know the speed of light.
		5.3.3	Explain the relationship of distance and intensity of light using a diagram.
		5.3.4	Measure the intensity of a small light bulb relative to a candle using a Bunsen or Joly photometer.
		5.3.5	Construct ray diagrams, relating focal length, image distance, and object distance for spherical mirrors and lenses.
		5.3.6	Make laboratory investigations of mirrors and lenses.
		5.3.7	Observe the magnification power of simple magnifiers.
		5.3.8	Make laboratory investigations of the wavelength/colors of light using a diffraction grating or prism.
		5.3.9	Investigate polarized light with polarizing filters.

Grade Level: 9-12 Skills/Subject Area: Physics--Applied/Technical

COMPETENCY GOAL 6: The learner will understand basic principles of electricity and magnetism.

Objectives	Measures
6.1 Know how to identify and explain certain electrostatic phenomena.	6.1.1 Conduct laboratory investigations of electrostatic attraction/repulsion and charge transfer.
	6.1.2 Explain the construction and function of a capacitor.
	6.1.3 Define and give examples of conductors, insulators, and semiconductors.
6.2 Know basic quantities and components associated with direct current circuits.	6.2.1 Make calculations and laboratory verifications of Ohm's Law.
	6.2.2 Conduct laboratory investigations of circuits containing resistors in series and parallel.
	6.2.3 Draw charts of simple electrical circuits.
	6.2.4 Compare the voltages in circuits containing cells in series and parallel.
	6.2.5 Conduct laboratory investigations of electrochemical phenomena related to time, current, and mass of material transferred in an electroplating circuit.

Grade Level: 9-12 Page 2

Skills/Subject Area: Physics--Applied/Technical

COMPETENCY GOAL 6: The learner will understand basic principles of electricity and magnetism.

Objectives	Measures
6.3 Understand basic terms and phenomena associated with magnetism.	6.3.1 Explain the origin of magnetism.
	6.3.2 Show the N-S conventions in diagrams describing magnets.
	6.3.3 Produce magnetic maps showing flux lines around a magnet using a small compass.
	6.3.4 Demonstrate the concept of the interrelationship between electricity and magnetism when given a coil of wire, galvanometer, bar magnets, and iron filings.
	6.3.5 Demonstrate the magnetic field associated with straight conductors and solenoids.
	6.3.6 Observe the strength of an electromagnet related to current flow and number of turns.
	6.3.7 Describe basic types of motors and generators.
	6.3.8 Describe the operation of a transformer.
6.4 Understand basic descriptive material pertaining to alternating-current circuits.	6.4.1 Describe the transmission, special properties, and measuring instruments related to alternating-current circuits.
	6.4.2 Describe some basic principles associated with vacuum tube and transistor circuits and their relationships to certain electronic devices (e.g., radio, oscilloscope, and TV).

SCIENCE

Grade Level: 9-12 Skills/Subject Area: Physics--Applied/Technical

COMPETENCY GOAL 7: The learner will understand some fundamental concepts of particle physics.

Objectives	Measures
7.1 Know about atomic theory and its development.	7.1.1 List and explain the major aspects of the atomic theory.
	7.1.2 Discuss the contributions of various scientists to the atomic theory.
7.2 Know about major aspects of quantum theory.	7.2.1 Discuss the development of the quantum theory beginning with the Bohr model.
	7.2.2 Draw a diagram assigning principal quantum numbers to the electrons of a specified atom.
	7.2.3 Discuss how quantum theory is used to explain atomic structure.
7.3 Know properties of major atomic particles.	7.3.1 Describe the roles that some particles play in the atom.
	7.3.2 Balance selected nuclear equations with respect to mass and charge.
	7.3.3 Demonstrate a knowledge of nuclear fission and fusion.
	7.3.4 Explain the operating principles of a pressurized water reactor.
	7.3.5 Compare the energy production of a nuclear station to more conventional means.
7.4 Know about practical applications of nuclear energy.	7.4.1 List uses of nuclear energy in medicine, research, and manufacturing.
	7.4.2 Discuss the significance of nuclear energy to society.

APPENDIX A

House Bill 1567*

A BILL TO BE ENTITLED AN ACT TO ENACT THE ELEMENTARY AND SECONDARY SCHOOL REFORM ACT OF 1984.

The General Assembly of North Carolina enacts:

Section 1. This act may be referred to as the "Elementary and Secondary School Reform Act of 1984."

Section 2. G.S. 115C-81(a) is amended by deleting the first paragraph and substituting the following:

"Standard Course of Study. It is the policy of the State of North Carolina to insure a quality education to every child residing in North Carolina. To this end, the General Assembly directs the State Board of Education to develop a standard course of study to be offered to every child in North Carolina public schools and to submit the proposed standard course of study to the General Assembly by October 15, 1984.

The standard course of study shall reflect a rigorous academic course of study stressing mastery of integrated knowledge based on mastery of competencies in the basic skill areas rather than the study of isolated disciplines. To this end, the State Board of Education is directed to undertake a statewide audit of current curricula and to refine the curricula as required to comply with this policy. The standard course of study:

1. shall stress mastery of integrated knowledge;

2. should provide students with the specific competencies needed to gain employment or to continue their education;

3. should provide students with the skills necessary to cope with contemporary society;

4. shall contain a vocational education component designed to meet the State's and local anticipated career training needs;

5. shall provide for a program of continuous learning based upon the individual child's need, interest, and stages of development, so that the program has a nongraded structure of organization;

6. shall set forth what subjects shall be taught in each grade, and outline the basal and supplementary books on each subject to be used in each grade;

7. shall include a core curriculum for all students plus additional elective curriculum choices to meet the varied needs and interests of students;

8. shall establish a minimum length of the instructional day;

9. shall prescribe standards for student performance and promotion and may consider appropriate levels at which remediation should begin; and

10. shall describe appropriate class size for each course required by the standard course of study; staffing levels to support the standard course of study, and may include minimum staffing for schools, regardless of size, where such schools are determined to be essential to serve pupils located in isolated geographic areas; minimum facility requirements for the standard course of study; minimum material requirements for the standard course of study; and such other information the Board finds necessary to enable the General Assembly to allocate appropriate resources to implement the plan."

*Includes only that portion of HB 1567 addressed by the Basic Education Program for North Carolina's Public Schools, the North Carolina Standard Course of Study, and the North Carolina Competency-Based Curriculum.

APPENDIX B

16 NCAC 2E.0103; STANDARD COURSE OF STUDY: POLICIES

(a) Definitions. As used in this Rule:

(1) "Standard Course of Study" means the program of course work for each of the various subjects taught in the elementary and secondary schools of the state, together with competency goals and performance indicators, as defined in (4) and (5) of this subsection, which have been adopted by the state board pursuant to G. S. 115C-81 (a) and subsection (b) of this Rule.

(2) "Curriculum guide" means a document prepared by the State Department of Public Instruction for each subject or area of study listed in the Standard Course of Study, including suggestions as to suitable instructional aids, textbooks and supplementary resources, learning experiences and teaching methods.

(3) "Course unit" means a minimum of 150 clock hours of instruction. Short courses will be credited in an amount corresponding to the fractional part of a total unit.

(4) "Competency goals" means the ends toward which student learning is directed.

(5) "Performance indicators" means quantitative measures of progress toward competency goals.

(b) The state board shall adopt and periodically review the Standard Course of Study, upon recommendation of the State Superintendent and pursuant to a public hearing and any changes the board deems appropriate. The Standard Course of Study shall be published by the state board. Copies of the Standard Course of Study and the curriculum guides may be obtained from the Department of Public Instruction, 116 W. Edenton Street, Raleigh, N. C. 27611.

(c) The Standard Course of Study shall include, at a minimum, a kindergarten through 12th grade program of studies in the following areas:

(1) citizenship, including the social studies-economics, history, government, sociology and human relations;

(2) communications, including foreign languages, educational media, and all phases and applications of English-language arts;

(3) cultural arts, including the fine and performing arts, recreation and avocations, addressed to both performance and consumer objectives;

(4) healthful living, including personal and community health, physical education, recreation, and safety;

(5) mathematics, including computational, problem solving, and consumer skills and substantive advanced elective sequences;

(6) science, including the basic study of all living and nonliving things as well as advanced elective sequences; and

- (7) vocational, including a developmental design, moving from occupational exploration in the middle grades, to selective specialization in the senior high school, as set out in the state Master Plan for vocational education.

(d) The development of subject and course content in the study areas listed in (c) of this Rule shall include, as appropriate for the various grade levels, the study of Americanism, the government of the State of North Carolina, the government of the United States, fire prevention, harmful or illegal drugs including tobacco and alcohol, and the free enterprise system.

(e) The Standard Course of Study shall be implemented in the kindergarten through eighth grades through an appropriate developmental program in each study area for individual pupils. Summer school for these grades is considered an integral part of the regular school term. The Standard Course of Study shall be implemented in the 9th through 12th grades through a program of representative course offerings in each study area.

(f) Graduation Requirements

- (1) In addition to the requirements of 16 NCAC 2G.0702, students graduating during or after the 1986-87 school year must successfully complete 20 courses units in grades 9 through 12 to be graduated from high school. These course units must include the following:
  - (A) four course units in English;
  - (B) two course units in mathematics;
  - (C) two course units in social studies; one unit in government and economics, and one unit in United States history;
  - (D) two course units in science, one unit in a life science or biology, and one unit in one of the physical sciences;
  - (E) one course unit in physical education and health;
  - (F) nine course units to be determined by the local education agency. These may be undesignated electives or designated from the study areas described in subsection (c) of this Rule.
- (2) Course work successfully completed in the ninth grade at a school system where course units are not awarded in the ninth grade shall be deemed to satisfy the requirements of (1) of this subsection.
- (3) Course work successfully completed by students in grades 9 through 12 at a summer school session may be used to satisfy the requirements of (1) of this subsection. Course units so taken shall be earned in the same manner as otherwise provided in this Rule, except that for students repeating courses in summer school the principal shall determine the hours of instruction required to be repeated.

(4) Course work successfully completed by students in grades 9 through 12 at an off-campus institution may be used to satisfy the requirements of (1) of this subsection. No high school may approve enrollment in post-secondary institutions during the regular school year in excess of five percent of its enrollment in grades 10-12 except as approved by the State Board of Education. Enrollment under this policy in community college institutions shall be in accordance with 16 NCAC 2E.0301.

History Note: Statutory Authority G. S. 115C-12(9)c; G. S. 115C-81(a);
Eff. February 1, 1976
Readopted Eff. February 3, 1978;
Amended Eff. April 1, 1983; June 8, 1979

APPENDIX C

COURSE REQUIREMENTS FOR HIGH SCHOOL GRADUATION

Course Units	Subjects
4	English
2	Mathematics
2	Social studies (1 unit in government and economics, 1 unit in United States History)
2	Science (1 unit in a life science or biology, 1 unit in one of the physical sciences)
1	Physical education and health
9	Determined by the local education agency (these may be undesignated electives or designated in the study areas of citizenship, communications, the arts, healthful living, mathematics, science, vocational education)

20 Total Course Units

APPENDIX D

NORTH CAROLINA STATE BOARD OF EDUCATION
NORTH CAROLINA SCHOLARS' PROGRAM

PLAN A

The North Carolina State Board of Education, believing that the success of our State and Nation depends on the full development of our youth and that some students should be encouraged to pursue a well-balanced but more vigorous high school program, institutes a North Carolina Scholars' Program.

Beginning with the 1983-84 school year, students satisfactorily completing requirements as identified by the State Board shall be named North Carolina Scholars and receive special recognition by the State Board.

Course Requirements

Program Area	Units
English	4
Mathematics - Algebra I, Geometry, Algebra II, one beyond Algebra II	4
Science - Biology, Chemistry, Physics (or in lieu of Physics, one other advanced science)	3
Social Studies - U. S. History, Government/Economics, World Cultures (Prior to 1987, U. S. History plus two elective units)	3
Foreign Languages - two levels of the same language	2
Health, P. E.	1
Vocational Education	1
Arts Education	1
Electives - minimum of three	3
	22

Additional Requirement

Students must have an overall four year grade average of B or its equivalent as determined by the local board of education. Equivalency may be determined by numerical grades or weighted grade point averages.

Recognition

1. Students meeting all requirements for a North Carolina Scholars' Program receive from the State Board of Education an appropriate seal of recognition to be affixed to the diploma.

2. Special recognition events should be held in the school and community to honor the students and their parents. These should include appropriate, special recognition at graduation exercises.

3. The State of North Carolina as well as business and industry should consider awarding other special recognitions to these students.

4. Colleges and universities should consider the North Carolina Scholars' achievement when making decisions concerning acceptance by their institutions.

5. An identification of potential candidates for this achievement should be made at the end of grade 11. Candidates would include those students who, after completing their selected senior courses with the designated grade average, would be eligible for recognition. This identification of candidates would reinforce the students' efforts to achieve the recognition and could also be included on their application forms and/or transcripts to colleges and universities.

NORTH CAROLINA STATE BOARD OF EDUCATION
NORTH CAROLINA SCHOLARS' PROGRAM

PLAN B

The North Carolina State Board of Education, believing that the success of our State and Nation depends on the full development of our youth and that some students should be encouraged the pursue a well-balanced but more vigorous high school program, institutes a North Carolina Scholars' Program with concentration in one or more program areas. In order to allow more flexibility in the program, consideration should be given to the optional sequence of courses listed below as an alternative to Plan A.

Beginning with the 1983-84 school year, students satisfactorily completing requirements as identified by the State Board shall be named North Carolina Scholars and receive special recognition by the State Board.

Course Requirements

Program Area	Units
English	4
Mathematics - Algebra I, Geometry, Algebra II	3
Science - Biology, Chemistry, Physics (or in lieu of Physics, one other advanced science)	3
Social Studies - U. S. History, Government/Economics, one additional social studies (Prior to 1987, U. S. History plus two elective units)	3
Foreign Languages - two levels of the same language	2
Health, P. E.	1
Vocational Education	1
Arts Education	1
Electives - minimum of four (concentrations may be selected as listed below)	4
	22

Concentrations

Mathematics - at least one additional advanced unit (balance - 3 electives)

Science - at least one additional advanced unit (balance - 3 electives)

Social Studies - at least one additional unit (balance - 3 electives)

Foreign Languages - at least two additional units of the same language (balance - 2 electives)

Health, P. E. - at least three additional units (balance - 1 elective)

Arts Education - as least three additional units (balance - 1 elective)

Vocational Education - at least three additional units (balance - 1 elective) Three of the minimum four units required for concentration in vocational education must be related to the same vocational objective. Additional units may be related to the same vocational objective or may be in other vocational areas.

Additional Requirement

Students must have an overall four year grade average of B or its equivalent as determined by the local board of education. Equivalency may be determined by numerical grades or weighted grade point averages.

Recognition

1. Students meeting all requirements for a North Carolina Scholars' Program will receive from the State Board of Education an appropriate seal of recognition to be affixed to the diploma.

2. Special recognition events should be held in the school and community to honor the students and their parents. These should include appropriate, special recognition at graduation exercises.

3. The State of North Carolina as well as business and industry should consider awarding other special recognitions to these students.

4. Colleges and universities should consider the North Carolina Scholars' achievement when making decisions concerning acceptance by their institutions.

5. An identification of potential candidates for this achievement should be made at the end of grade 11. Candidates would include those students who, after completing their selected senior courses with the designated grade average, would be eligible for recognition. This identification of candidates would reinforce the students' efforts to achieve the recognition and could also be included on their application forms and/or transcripts to colleges and universities.

APPENDIX E

NORTH CAROLINA COMPETENCY-BASED CURRICULUM

Sample Page

Grade Level: 6 Skills/Subject Area: Social Studies/Knowledge

Competency Goal: 1. The learner will know that ways of living change over time and how and why these changes occur (history).

OBJECTIVES	MEASURES
1.1 Identify changes which have occurred in Europe and/or the Soviet Union.	1.1.1 List changes which have occurred when given an appropriate series of photographs depicting changes in ways of living (dress, housing, work, transportation, and entertainment) in Europe and/or the Soviet Union.
	1.1.2 Draw a picture depicting what s/he believes to be the most significant change to have taken place in Europe or the Soviet Union; describe the picture and explain her/his reasoning aloud to the rest of the class.
1.2 Identify the effect of important changes which have occurred in Europe or the Soviet Union.	1.2.1 Place the examples in chronological order when given appropriately chosen examples of change in Europe or the Soviet Union.
	1.2.2 Match the changes to the resulting effects and identify the country in which each change/effect occurred when given a list of changes and a list of effects.

APPENDIX F

TESTING REQUIREMENTS

Annual Testing Program

The Annual Testing Program consists of standardized tests in reading, language arts, and mathematics administered at grades 1, 2, 3, 6, and 9.* Beginning with science and social studies tests, other skills and subject areas may be added to this program in the future.

Promotion Testing

Phase 1: A student in grades 3, 6, or 8 who scores at or above the 25th percentile (total battery) in the Annual Testing Program meets the State standard for promotion and must them meet local requirements. A student who scores at the 24th percentile or below enters phase two.**

Phase 2: In phase two, a student is tested for mastery of competencies on a test developed by the State Board of Education. Students who demonstrate mastery meet State requirements and then must meet local requirements. Students who do not demonstrate mastery must be retained or attend a State-supported summer remediation program. Students attending the summer program will be assessed to determine whether they have mastered the minimum standards. Those who demonstrate mastery will have met State standards and may be promoted if they have also met local requirements. Those who have not demonstrated mastery will be retained.

End of Course Testing

End of Course Testing is conducted at the secondary level in Algebra I and biology. It is anticipated that up to 20 other courses may be added to this program by the year 1990.

Minimum Competency Testing

Students in grade 11*** are tested for mastery of minimum competencies in the areas of reading and mathematics. In order to graduate from high school, students must receive a passing score on all areas of the Minimum Competency Test.

* It is anticipated that testing will be moved from grade 9 to grade 8.

** The State standard will not apply to students already retained in the same grade span or certified as trainable mentally handicapped, educable mentally handicapped, or severely/profoundly mentally handicapped. Students otherwise handicapped may also be exempted according to standards and procedures developed by the State Board of Education.

*** It is anticipated that testing will be moved from grade 11 to grade 10.

APPENDIX G

TEXTBOOK ADOPTION PROCESS IN NORTH CAROLINA*

The first step in the adoption of basic textbooks is the appointment of a Textbook Commission as set forth in G.S. 115C-87. The law provides that the Textbook Commission shall be composed of fourteen members to be appointed by the Governor upon the recommendation of the State Superintendent of Public Instruction. The law further prescribes that seven of the members shall be outstanding teachers or principals in the elementary school grades, that five shall be outstanding teachers or principals in the high school grades, and that two shall be lay members, one of which shall be the parent of an elementary school student, and one of which shall be the parent of a high school student, with the added proviso that one of the members may be a county or city superintendent.

The State Board of Education authorizes textbook adoptions as set forth in G.S. 115C-85 and 86. The State Superintendent notifies members of the Textbook Commission that there is to be an adoption in a given subject area or areas. The State Superintendent also notifies all registered textbook publishers of the adoption call and invites them to submit any materials they would like to have considered.

Members of the Textbook Commission evaluate all textbooks offered for adoption.

All books submitted are viewed and evaluated within a frame of reference determined by the State course of study. Pursuant to a call and prior to reviewing materials, members of the Textbook Commission and the professional staff of the Department of Public Instruction engage in a thorough overview of the program of studies and develop a concise statement of philosophy, goals, and objectives for the course or subject area under consideration. This statement also reflects any changes or innovations in the program and takes into account current trends and emphases stemming from sound, authoritative research, and experimentation.

In the review and evaluation process each Commission member secures the help of as many advisers as he or she may choose. The number will vary but the usual practice has been for each member to select eight to twelve such advisers. Special expertise in the subject area under consideration is the main criterion in choosing advisers. Each Commission member tries to secure a representative group including classroom teachers, college personnel, supervisory and administrative personnel, and possibly laymen and students.

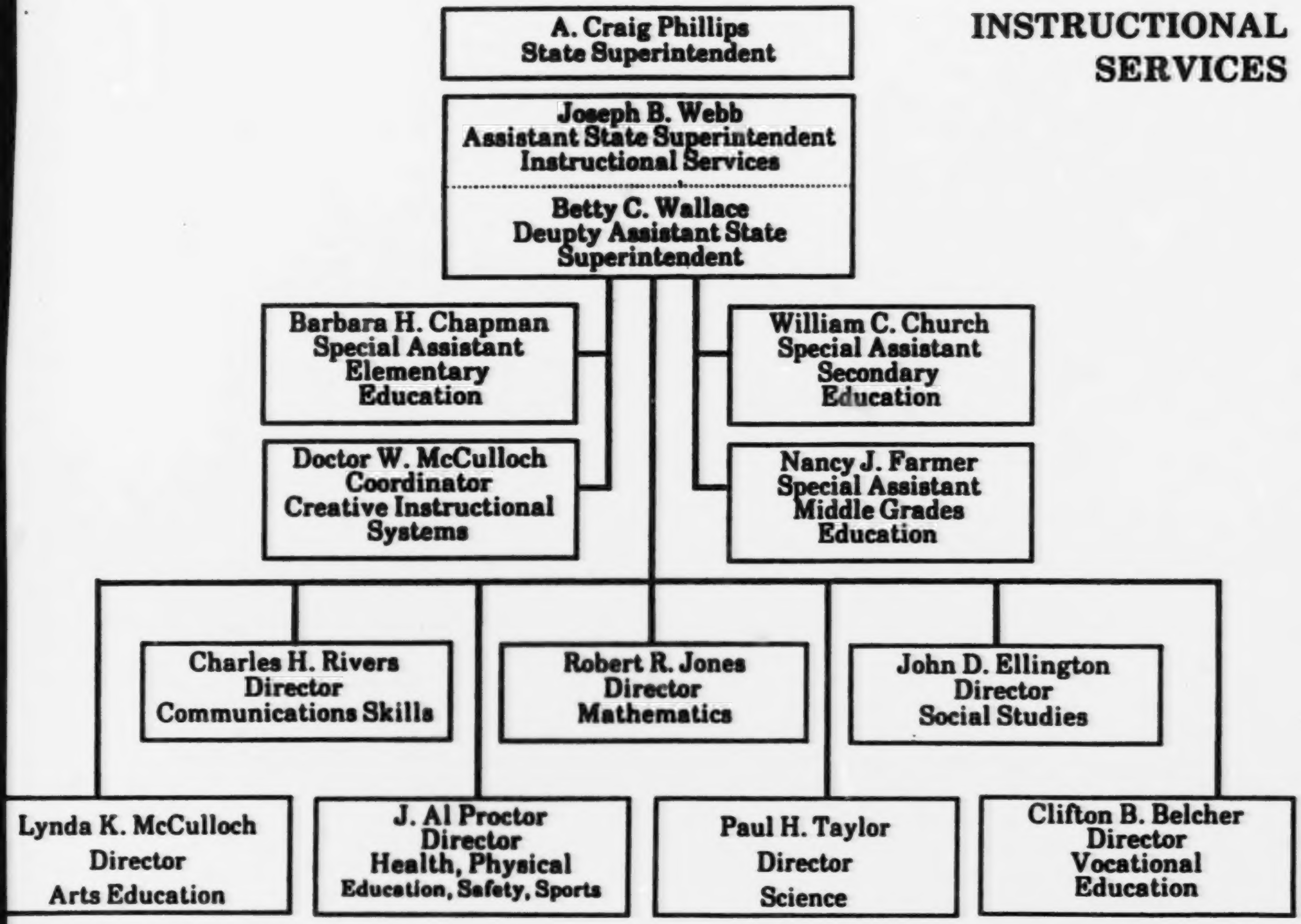
*From North Carolina State Adopted Basic Textbooks 1984-85. Raleigh, NC: Division of Textbooks, Controller's Office, Department of Public Education, 1984.

When the review process is completed, each Commission member files a written evaluation of every book submitted. These evaluation reports must be signed by the member making the report and the Commission Chairman delivers them to the State Superintendent who is also Secretary to the State Board of Education. At the next meeting of the Board of Education, after evaluation reports are filed, the members of the Textbook Commission meet with the Board for joint review and consideration of the reports. In the evaluation of basic textbooks the members of the Commission do not concern themselves in any way with the price of the book or its physical features.

Following the joint session of the Textbook Commission and the State Board to consider the findings and recommendations of the Commission, the State Board officially calls for sealed bids on those books which the Textbook Commission found to be most appropriate for implementing the desired program of instruction in North Carolina schools. Bids are customarily received on five to eight books. At the next meeting or at another designated regular meeting of the Board, the bids are opened and contracts awarded. Where significant differences in the appropriateness of books were noted by the Textbook Commission, the State Board traditionally has placed priority on securing the best materials available.

APPENDIX H

INSTRUCTIONAL SERVICES


A. Craig Phillips
State Superintendent
Joseph B. Webb
Assistant State Superintendent
Instructional Services
Betty C. Wallace
Deupty Assistant State Superintendent
Barbara H. Chapman
Special Assistant
Elementary Education
William C. Church
Special Assistant
Secondary Education
Doctor W. McCulloch
Coordinator
Creative Instructional Systems
Nancy J. Farmer
Special Assistant
Middle Grades Education
Charles H. Rivers
Director
Communications Skills
Robert R. Jones
Director
Mathematics
John D. Ellington
Director
Social Studies
Lynda K. McCulloch
Director
Arts Education
J. Al Proctor
Director
Health, Physical Education, Safety, Sports
Paul H. Taylor
Director
Science
Clifton B. Belcher
Director
Vocational Education

APPENDIX I

Suggestions for Additions to or Revisions of the

North Carolina Competency-Based Curriculum

1. Suggestion for: A. addition / / B. revision / / (please check one)

2. Skills/Subject Area: ____________________
(e.g., Mathematics, Social Studies, Science)

3. Page Number: ______

4. Addition/Revision to: (please check & give number)

Introduction	/ /	
Competency Goal	/ /	Number: ______
Objective	/ /	Number: ______
Measure	/ /	Number: ______

5. SUGGESTION: ____________________

6. Name of person submitting suggestion: ______
Place of employment: ______
Employed as: ______
Address: ______

Please return this form to:
Joseph B. Webb
Assistant State Superintendent
for Instructional Services
Education Building, Raleigh, NC 27611